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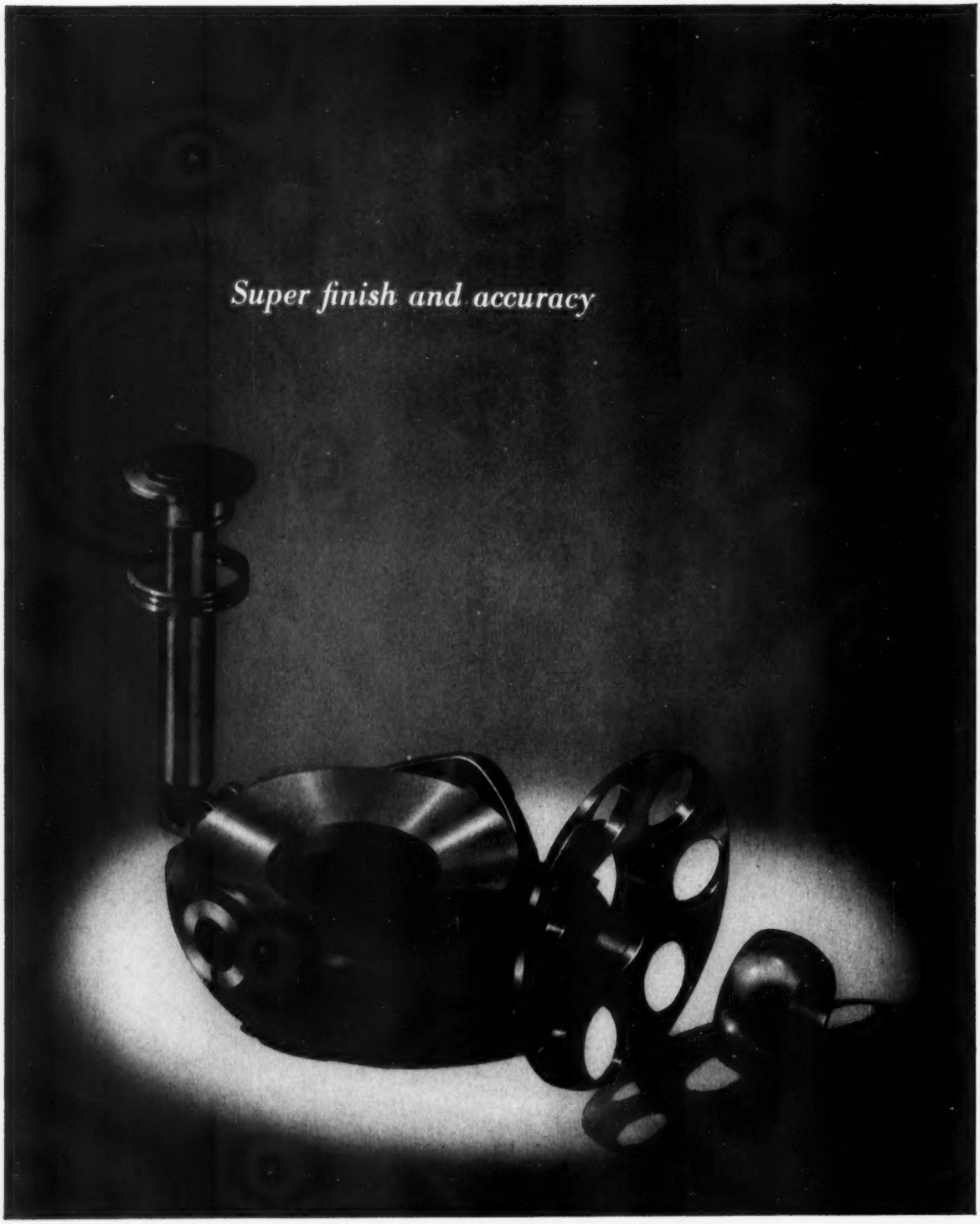

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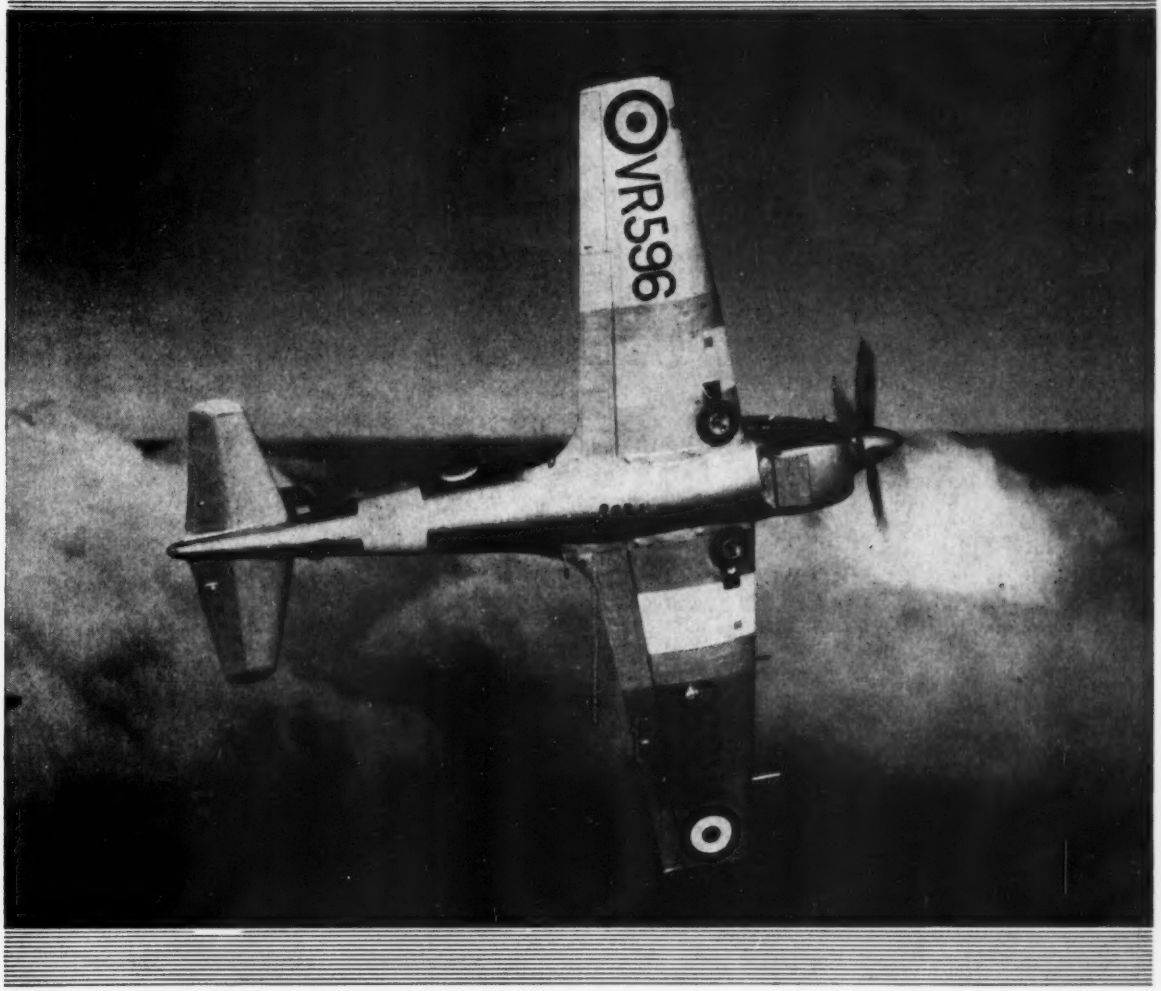

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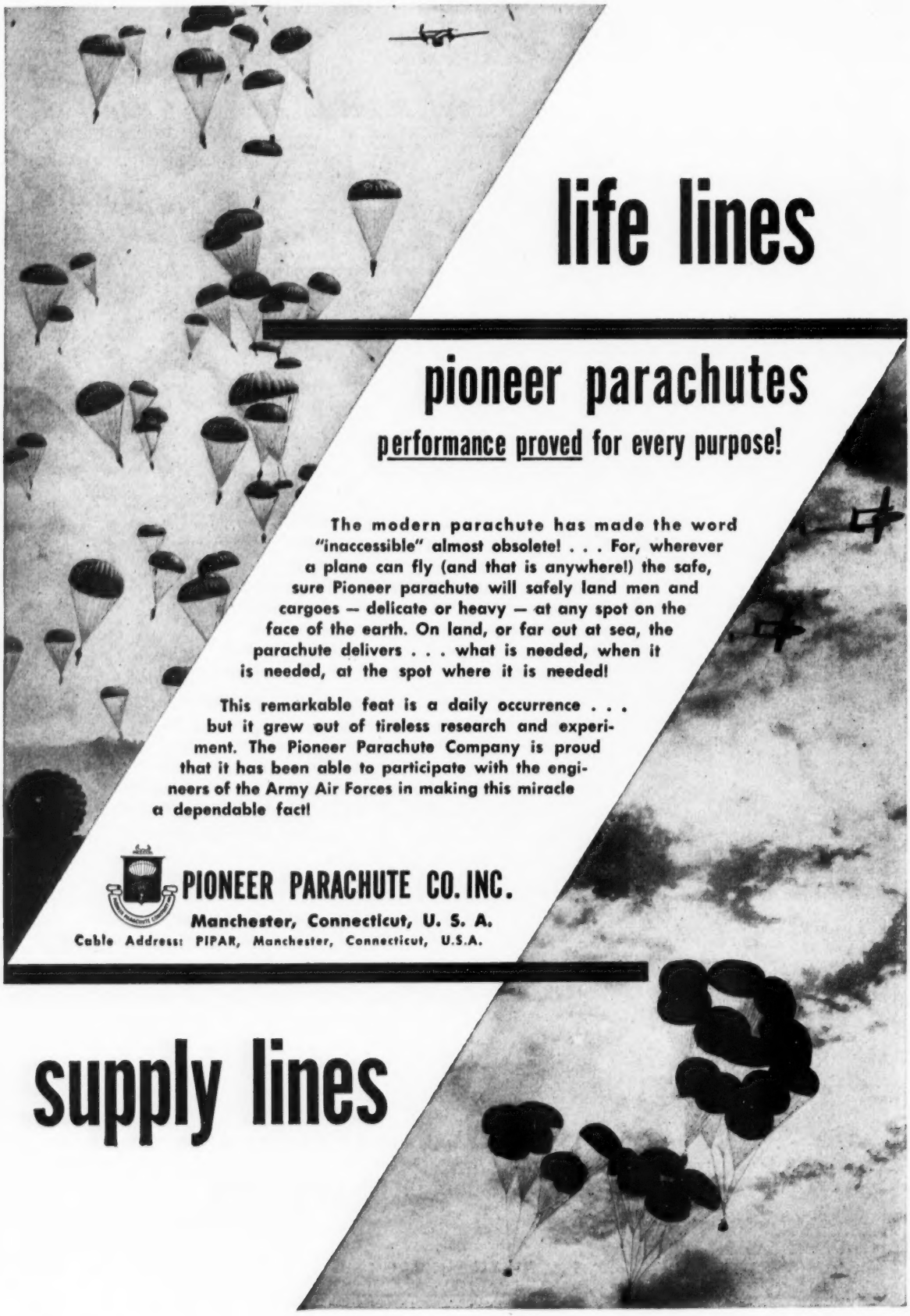

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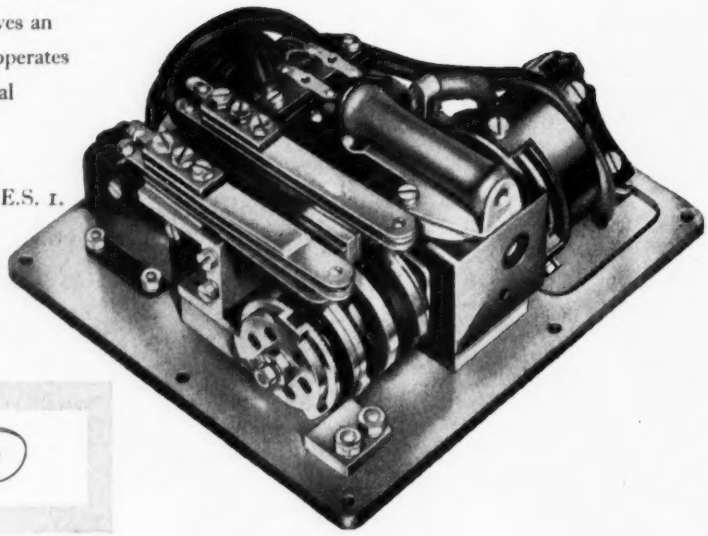

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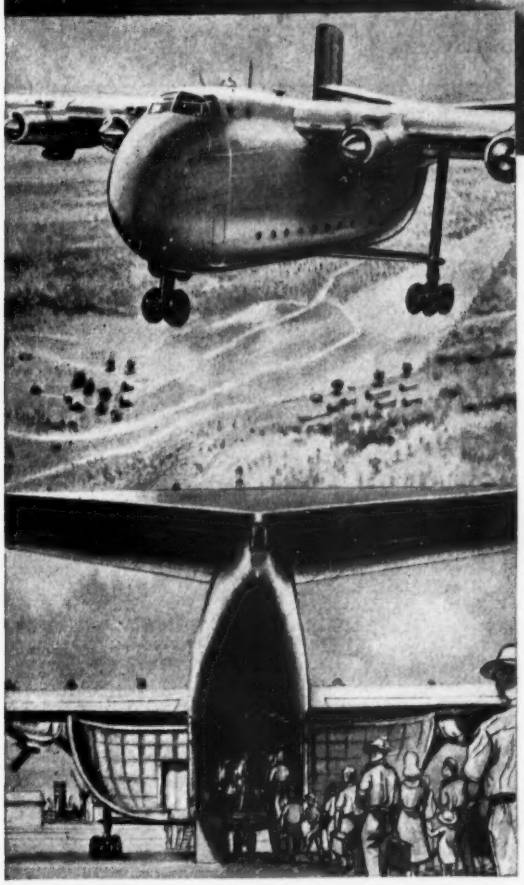

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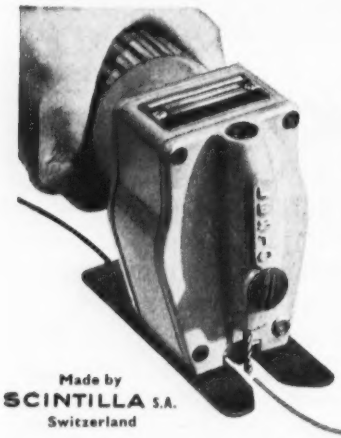

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Jungle Lessons

LAST week saw Bomber Command engaged on its most important exercise since the war. It was code-named "Jungle King," said the A.O.C.-in-C., Air Chief Marshal Sir Hugh P. Lloyd, because the lion was king of the jungle and today we lived in pretty much of a jungle. At some other time, *Flight* would like to take up the aptness of this simile with Sir Hugh, because we have yet to hear of any but mythical lions which have grown wings, and we also believe that, because elephants have been known to triumph over lions through sheer strength and weight, the two have come to an understanding not to "mix it." However, here our purpose is to record first impressions of an R.A.F. exercise which from every point of view seems to be the most valuable of its kind to date.

As is always the case, a full assessment of results will entail many weeks of analysis, but it is not too soon to appreciate that "Jungle King" has been the most realistic of exercises. The widespread bomber raids over Europe, and the employment of new methods and tactics, sets it apart from previous air manœuvres, just as the increasing employment of Canberra bombers is making the retention of dated operational practices impossible. As to the attention to detail, *Flight*'s representatives who visited squadrons and flew with Canberra and Washington crews were greatly impressed with the "operational" atmosphere and the seriousness with which every man tackled his work. The exercise was clearly a realistic dress-rehearsal for all ranks.

From all the indications we received, defence exercise "Ardent," staged for Fighter Command last October, brought out two points clearly: the first that the Command was shaping well, and had been greatly strengthened; and, secondly, that it was a long way from being effective against Canberras and jet bombers of similar or even better performance. Interception of fast, low-level intruders also continued to pose real problems.

By day there are now some Allied fighters which can make a pass at Canberras operating without height and speed restriction. By night these 40,000ft-plus bombers are still likely to flash on unmolested. Moreover, specially selected crews are understood to have been trained to carry out simulated atomic attacks by individual aircraft. This is something new, which lays stresses on the need for delivery of more Canberras and for the later "V-bombers" without a day's unnecessary delay. It also suggests that the time has come to discard the Washingtons and faithful Lincolns of Bomber Command which, frankly, can serve little useful purpose in the European theatre.

New radar and weapons are seldom discussed in detail, but it is clear that their development, production and deliveries are not exactly ahead of requirements. All the same, it is gratifying to read that, having flown round the bomber stations in his Meteor, Sir Hugh Lloyd was able to report that radar target photographs were accurate. Reconnaissance aircraft had also obtained excellent photographic coverage. At the conclusion of the Exercise last Sunday, the A.O.C.-in-C. reported increasing bombing accuracy despite the intensity of operations. It seems that today small practice-ranges can safely be used by aircraft flying at 40,000ft at 450 kt, but he also added that the force would never achieve pin-point accuracy with the free-falling bomb. The development of the guided bomb would be the biggest contribution which a scientist could make towards preventing war.

On more than one occasion diversions were necessary when aircraft were returning to base areas in the British Isles. With comparatively small numbers of machines engaged, homing and control of returning forces—and particularly G.C.A. landings for the Canberras—were carried out successfully. As more of Bomber Command's machines become jet-powered, and bearing in mind the local dislocations to be expected in war-time, the task of landing large forces back at their bases at night and in bad weather may become one of the most difficult to achieve. Such machines cannot "hold," nor do they take kindly to diversions. Technically much has been learned from "Jungle King." Jet aircraft have proved easier to maintain, and there have been virtually no Avon engine failures in the Canberras. If all branches of the organization can keep a pace ahead of requirements and are, in fact, already able to stand the strain of intensive operations, then the foundations have been well laid.

"JUNGLE KING"

Bomber Command's Big Exercise: A Typical Sortie Described

At Bomber Command headquarters: Air Chief Marshal Sir Hugh P. Lloyd (right) with his S.A.S.O., A.V-M. G. D. Harvey and Group Capt. Operations, G/C. J. N. Tomes, discuss the routeing of the early bomber raids in "Jungle King." The more northerly courses are for Lincolns and those over Holland for Canberras.

LAST week, the biggest exercise held by Bomber Command since the war took place over a large area of Western Europe, raids originating in this country being directed against targets in the Allied Zone of Germany. The operations were under the command of the A.O.C.-in-C., Air Chief Marshal Sir Hugh P. Lloyd, K.B.E., C.B., M.C., D.F.C.

Apart from its value as a realistic test of operational tactics and techniques, the exercise—code-named "Jungle King"—also provided an opportunity for a full-scale, round-the-clock test of Bomber Command's war organization. Equally valuable was the practice it gave to the defensive units, which consisted of squadrons from Allied Air Forces Central Europe, including R.A.F. units of 2nd A.T.A.F.

The strategic assumption was that an Eastern Continental power, "Magenta" was attacking in a westerly direction. The enemy had reached the Rhine, and Bomber Command was operating in support of the Allied ground forces.

Tactically, one of the most important features of "Jungle King" was the employment, for the first time in such an exercise, of single aircraft against single targets, thus simulating future atomic-bombing techniques. Canberras were used for some of these attacks, the other aircraft concerned being Lincolns, Washingtons and Mosquitoes. It is believed that much of value was learned in regard to the eventual use of the "V" (Vulcan, Victor and Valiant) bombers in such a rôle. Only a proportion of the attacks were of this kind, others being made by either moderate-sized or small formations. Radar techniques were extensively employed for the location and attack of targets. Although results have not been announced at the time of writing, it seems clear that the defending fighters—notably Venom N.F. 2s—showed a high level of efficiency.

Widespread fog over England complicated the exercise, diversion of returning bombers to widely dispersed alternative airfields being necessary on several occasions.

Operations during the first three days of the exercise may be briefly summarized as follows :—

March 16th-17th.—Operations were aimed mainly against the enemy's air support, which was seeking to establish bases at Nordhorn (which is in reality a live-bombing range north-west of Munster) and at Fuhlsbuttel (near Hamburg) and Bremen. Canberras operating from bases in Lincolnshire dropped live bombs at Nordhorn, Washingtons attacked Fuhlsbuttel and Lincolns went to Bremen. There were many interceptions by defending fighters. Meanwhile, enemy intruders—U.S.A.F. B-26s from Germany—attacked bomber bases in Lincolnshire.

March 17th-18th.—Targets for Canberras, Washingtons and Lincolns were Jever (Wilhelmshaven), Wunstorf and Celle. Weather over the targets was clear and good results were reported but considerable diversions were caused by fog on the return.

March 18th-19th.—Two forces of Canberras penetrated deeply into Germany in daylight to attack the airfields of Furstenfeldbruck (Munich) and Rhein-Main (Frankfurt). The assumption was that 45 enemy swept-wing fighters were refuelling at the first target and that an enemy general, in a four-engined jet transport with a fighter escort 45 strong, was calling at the second.

Photographic reconnaissance having revealed that the "Magenta" force—now astride the Kiel Canal—were intending to pass shipping through from the Baltic to the North Sea, Lincolns from Upwood, laid sea mines at either end. A powerful enemy cruiser (actually a large merchant ship carrying timber) was seen from the photographs to be on passage through the Canal, and shipping was massing in Kiel Bay.

March 19th-20th.—Operations included an attack—against Bremen airfield—by the biggest single force of Canberras yet to operate.

Activity began shortly after 1730 hr, when five Canberras made a very-low-level raid on a pinpoint target—the Ladbergen aqueduct carrying the Dortmund-Ems Canal over a river just north of Munster. Photographic reconnaissance had revealed that heavy equipment was being moved down the canal to a big supply depot at Munster. It was hoped to stop this traffic and so disrupt the enemy's communications, drain the canal and inundate the countryside. Despite thick haze the attack was highly successful.

At 1845 hr the largest number of Canberras ever to operate as a single force made a successful attack on Bremen airfield, which is among a number of bases where the "Magenta" Tactical Air Force had ground/attack aircraft in strength. There was one report of a night fighter being seen.

Attacks on other airfields in North-West Germany were timed to take place within 55 minutes of the Bremen raid, the object being to confuse and spread the enemy's night-fighter efforts.

At 1930 a strong force of Lincolns was preceded to the target by a small Pathfinder force of Canberras which dropped target indicators on the range at Nordhorn. The Lincolns dropped live bombs on the range, and interrogation reports showed that their bombing was both accurate and intense.

The other two diversionary raids were made by medium forces of Lincolns on Bückeburg airfield at 1940 hr and by Washingtons on Gutersloh airfield 10 minutes later. They reported moderate night fighter activity in the target areas and on withdrawal.

An account of a typical night sortie in a Washington, by a member of the staff of *Flight*, is given below. Next week an account of a Canberra raid, as seen from one of the aircraft, will be given.

Laying it out: Equipment is spread on a "prayer mat" as a Washington crew at Marham prepared to take off on the raid described here.

A RAID ON WUNSTORF

ON Wednesday of last week, Washingtons from R.A.F. station, Marham, made a night raid on the "hostile" airfield at Wunstorf, in Germany, and the writer was privileged to fly as observer in one of the aircraft.

Proceedings opened with the various special briefings for individual members of the crews, from which correspondents were excluded on security grounds—and then came the general briefing, for all concerned. On the wall at the head of the room was the familiar map of Europe, with our designated tracks marked clearly in black cord. We saw that the target was Wunstorf, situated about 50 miles south-east of Bremen, and—we were not too unhappy to note—30 miles or so west of the thick green line that marked the edge of Russian-occupied territory. The briefing was by W/C. H. N. G. Wheeler, D.S.O., O.B.E., D.F.C., in the presence of the station commander, G/C. O. R. Donaldson, D.S.O., O.B.E., D.F.C., and two other group captains who, from Command H.Q., were taking part as observers. We were fully instructed as to the intelligence and meteorological situations, and told that ten Washingtons and four Lincolns were making the raid, all being due over the target within a few minutes of one another. The various crews then dispersed after a time check had been given at 1556 hr.

Our aircraft was U-Uncle, but for purposes of the exercise the call-sign Fox had been allotted. In front of the big machine was spread a "prayer mat," and on this was laid all the safety and other equipment carried by the crew, so that a thorough check could be made by the captain of the aircraft—F/L. F. Dyke—an Australian pilot of some 8,000 hours' experience. All was found to be in order, and soon the engineer was to be seen on top of the wing checking the fuel and oil levels, while navigator, radar operators and gunners saw to their equipment, and the skipper kept a general eye on the proceedings. Finally everything was prepared, and we had half-an-hour or so to fill in before adjusting our flying clothing, donning mae wests and back-type parachutes, and climbing up the ladder into the aircraft.

The interior of a Washington is extremely capacious and well-appointed. Each pilot has his position, equipped with full flying controls and instruments: between them is the bombardier's station, complete with bomb-sight, radar altimeter and all the necessary gadgets of his trade. Behind the co-pilot is the admirably instrumented engineer's position, and opposite him sits the navigator, operating with chart and Gee-box. Back from here runs the long, rather claustrophobic tunnel, and in rear are the radio and radar operators, and the main fire-control sighting position for the numerous guns. These guns, incidentally, had live ammunition in the magazines: no chances were being taken after recent tragic events.

The Night's Work Begins

Captain and co-pilot set to work with the check-list as soon as we were all installed, and a few minutes later the big Cyclone R-3350s broke one by one into life. We taxied out, did our run-up into wind near the end of the runway, watched the first six aircraft rumble along the runway and disappear into the gathering gloom—and then, at 1750 hrs., dead on time, F/L. Dyke swung Fox smoothly into position, and we accelerated rapidly into the air under the influence of 2,000 b.h.p. from each engine; 42in and 2,800 r.p.m. were the figures indicated by the gauges.

Cloud-base was at approximately 1,000ft, and almost immediately we were in it, swinging round to set course over the airfield at 3,000ft. according to the flight plan. We were lucky. Suddenly, at 2,500ft, we shot out into a madly rushing, leaning world above the cloud-tops—and there was the sun, shining brightly, and two other aircraft in sight ahead of us, one just brushing the white floor of this scintillating scene, the other flying well clear.

And so, as the sun sank gradually behind us, we set course in an ENE. direction for position C—the point from which we were to turn into the coast for our attack. The captain throttled back to 29in boost and 1,800 r.p.m., and the engineer selected auto-lean. I.A.S. was 185 m.p.h., navigation was largely by Gee—and the most noticeable thing to the passenger was the remarkable lack of noise.

Ordinary speech was entirely practicable. During this leg the captain was kind enough to let me try the controls from the second pilot's seat, and I was impressed by the Washington's stability and the excellence of aileron control. Elevators and rudder seemed heavy, but were certainly effective enough. In spite of the greater size of the aircraft, the controls in general seemed to compare favourably with those of the Liberator and Halifax, with which I was familiar during the war.

At 1846 we started our climb to altitude—I.A.S. 220 m.p.h., 40in and 2,400 r.p.m., auto rich: this flat, relatively high-speed climb may seem surprising, but has proved the answer to certain overheating troubles encountered at lower air-speeds. Soon the pressurization system started to work, and the engineer showed me the relevant dials for cabin and outside indications, and explained also the complex log which he constantly had to keep, with predicted consumptions on one side and actuals on the other. Car enthusiasts may like to know that the a.m.p.g. of a Washington on a typical sortie is of the order of 0.5 !

At 1906 the final vestige of daylight faded, and the stars shone brightly in a clear sky. Two minutes later we reached position C and turned south-east, and four minutes after that the climb was complete, and we levelled out at 19,600ft indicated altitude at 180 m.p.h. I.A.S. Power setting was again 29in and 1,800 r.p.m. Soon afterwards the cloud below began to break, and the lights of the coast came into view. At this point the radio-altimeter was checked, and I was allowed to manipulate the green, wavering, phosphorescent circle that swam into view, and obtain a reading from the blip that spoiled the symmetry of the trace. We were at 20,500ft—and a pleasantly warm breeze was blowing through the cockpit from the diffusers in the nose. At 1919 we crossed the coast and the faithful blip on the altimeter registered 15ft or so less—a most admirable instrument.

Soon afterwards we saw another Washington on our port quarter—and then came excitement, as a sinister dark shape appeared by our starboard wing-tip, and in the gloom we could just distinguish the outline of an N.F.11 that had crept upon us unobserved, and was now shining a light to indicate an interception. There was no doubt about it; this particular fighter had a "claim" to his credit.

At 1951 we turned eastwards to the target, and all the gunnery switches except the fire-and-safes were turned to "on"—just in case. Navigation had been by radar fixes over Germany, and soon the navigator came up to the nose for the bombing run, and I was able to examine the radar-repeater screen fitted in his position—and make precisely nothing of what I saw. Over the intercom one could hear the "steadies" being given to the captain as the target drew nearer—and, finally, at 2003, with other Washingtons discernible, and 45 seconds early on E.T.A.—the "bombs" were released. The crew claimed later that a first-rate run had been made, in spite of the fact that part of the radar became u/s at the critical moment.

So the aim of the mission had been accomplished, and we turned gradually to port until the heading was 260 deg, and set out for home. Ahead in an inky black sky blazed Venus and Saturn, and between them was the new moon, holding the old in her arms. At least one of the Washington's crew ruminated on the insignificance of man and his inventions.

Twice on the way back we were again intercepted by N.F.11s, which came and formated right by our very wingtips; but our eagle-eyed gunners spotted the fighters as they approached and showed their lights first, indicating that they had opened fire. Each time the attackers would leave us, ahead and downwards, and only the tell-tale glow of the twin jets traced their path as they sank away.

At 2031 the turret switches were turned off, and half an hour later we again crossed the coast and started our descent at an air speed of 220 m.p.h. Back in the nose, I was able to listen in to V.H.F. control from Marham tower, and hear the aircraft being "stacked" before landing. Once over land again, on came our navigation lights, and we were ordered to 5,500ft. The usual English haze was inevitably with us, and it was a little emotioning, from time to time, to watch the next aircraft below swim suddenly into sight not far away—though in fact all aircraft in the stack were separated by a height of 500ft.

Slowly we dropped down, stage by stage—and the misty-red moon disappeared as the turbulent cloud swept up to meet us. Then at last came 2,000ft, and a change of frequency over to G.C.A. In we came towards the airfield, talked down and down by the confident voice—1,500ft, 1,000, 700 . . . and suddenly the clouds broke, and little twinkling lights could be seen against the black carpet of the ground. Soon the runway came into view—two lines of dimmed, "war-time" lights—and the unseen voice urged us ceaselessly towards it, purring out heights and directions.

Conditions could have been very bad indeed; we should still have arrived at the correct point. And then the runway lights were rushing frantically towards us; No. 1 engine failed to respond to control but it was too late to matter; there was a slight jarring bump as the main wheels touched, another a little later as the nose came down—and we were safely back on *terra firma*. It had been an excellent landing, despite the fact that the use of landing lamps was forbidden.

Slowly we cleared the runway, switched off the suspect engine and its opposite number, and taxied carefully between the rows of blue and amber lamps to our dispersal. A ground-crewman waved and signalled with his illuminated "hands"; the last two great engines sighed and stopped. The trip was over—or, at least, all over bar the de-briefing. It had been a memorable night.

D.I.C.

FROM ALL QUARTERS

Marshal Tito Sees the R.A.F.

ON Wednesday of last week Marshal Tito paid a visit to the R.A.F. station at Duxford, Cambridge, where he was greeted on arrival by the Secretary of State for Air, the Minister of Supply, Marshals of the R.A.F. Lord Tedder and Sir John Slessor, and Sir Lionel Whitby, Vice-Chancellor of Cambridge University. A flying display, arranged in honour of the Marshal, was unfortunately marred by a mid-air collision between two Meteors following a series of formation aerobatics. Both pilots lost their lives and the subsequent flying programme was slightly curtailed. Before the display began, Marshal Tito had indicated that he was quite prepared for it to be cancelled in view of the low cloud ceiling, but he was assured that it was considered safe to continue.

As the visitor was leaving the stand from which he had watched the display, a triple supersonic bang was heard, made by a Hawker Hunter flown by Neville Duke. It was later stated that a Supermarine Swift, piloted by Mike Lithgow, had also exceeded the speed of sound, but the resulting bang was not heard at Duxford.

This Year's Major Air Races

SUPPLEMENTING the information given in our issue of January 9th, the Royal Aero Club has now issued further details of the major British air races planned for the coming summer. The first such meeting will be the Goodyear Challenge Trophy Race, which will be held, as usual, at the Municipal Aerodrome, Wolverhampton, on Saturday, May 16th. On the 30th of the same month—three days before the Coronation—the Welsh Aerial Derby will be flown from Fairwood Common, near Swansea. This will be a revival of a popular pre-war event.

The National Air Races (consisting of the Grosvenor Challenge Cup, the Norton-Griffiths Challenge Trophy and the Kemsley Challenge Trophy, for aircraft of different weight classes) will be flown from Southend-on-Sea Municipal Airport on Saturday, June 20th. These contests will be flown over three laps of a ten-mile circuit shaped like a flat parallelogram running east-west. At each end of the course—at Mucking Hall and Flemings—there will be a pair of turning points spaced about half a mile apart, to provide sufficient radius for the turn on to the reciprocal. The airfield lies approximately in the centre, with the long sides of the course passing over its northern and southern boundaries.

Successful British entries in these three races will qualify for the King's Cup Race, flown during the same meeting. Entry forms for the "Nationals" are now available, and it is of interest to note that they make provision for turbojet and turboprop aircraft with methanol/water injection and re-heat!

The final major race of the season will be the Siddeley Challenge Trophy race to be held at Baginton, Coventry, on Saturday, August 22nd. Like all the above entries, the results of this race will influence the choice of British Air Racing Champion for 1953. To be eligible for the championship a pilot must enter in at least two races, but may fly a different machine on each occasion.

Nottingham U.A.S. Dines

THE annual dinner of the Nottingham University Air Squadron was held on Tuesday of last week at R.A.F. Station Newton. The N.U.A.S. has its very comprehensively equipped headquarters at Beeston, within half a mile of the University, and flying is carried out from the excellent grass airfield at Newton, 14 miles away. Establishment is for up to 60 students, some of whom come from the neighbouring Technical College at Loughborough. A non-flying technical course has recently been added to the College curriculum, and 11 students are taking it. Commanding the unit—which flies four Chipmunks and one Harvard—is S/L. R. P. Elliott, D.S.O., D.F.C., and he has four instructors and an adjutant under him.

After last week's dinner, the toast of "The Guests" was proposed by S/L. Elliott, who gave a brief outline of the squadron's activities during the past year, mentioning in particular the success of the camp held in the summer at Silloth, when 900 hours were flown without accident. The Vice-Chancellor of the University, Mr. B. L. Hallward, M.A., replied on behalf of the guests, and stressed the importance in the modern world of air affairs, and the great need for scientists and technicians.

Air Vice-Marshal C. A. Stephens, C.B., C.B.E., M.C., S.A.S.O., Home Command, next proposed "The Squadron," and spoke of, among other things, the vital rôle of Bomber Command in any future war. He then presented the two Kingsley Wood Auxiliary and Reserve Forces shooting trophies that had been won last year at Bisley, one by the unit team under P/O. Griffiths, the other individually by P/O. Towell. The proceedings were closed by P/O. Griffiths, who thanked the guests for their support.

Dinner at Cranfield

THE fifth annual dinner of the Senior Common Room Society of the College of Aeronautics will certainly go down as one of the most successful and enjoyable. The opportunity these functions provide for members of Senior Common Room and guests—who on this occasion represented all sections of the aeronautical world—to indulge in shop talk of mutual interest is in itself most valuable.

The first toast after dinner was that of the College, proposed by Mr. K. W. M. Pickthorn, Parliamentary Secretary to Ministry of Education. He skilfully mixed humour with good advice. Having stated that the success of the college depended upon the respect in which the staff were held, upon its resources and, most of all, upon the quality of the entry, Mr. Pickthorn said that pressure should be put on those who could spare the best types of men to release them for teaching. If the country did not continue in greatness it could not continue in comfort.

Air Marshal Sir Victor Goddard, the principal, thanked Mr. Pickthorn in reply, recalling their first meeting in 1925 at the formation of the Cambridge University Air Squadron. Cranfield had the same idea of basic excellence in the air.

Not only the quality of men the College got, but also the time factor mattered, said Sir Victor. Several years would pass before the men could exert their influence. Reference was made to the College's continued housing problems and then Sir Victor went on to say how great an encouragement had been the visit of the Duke of Edinburgh.

Sir Victor spoke of the loss to the College of Mr. Knight and Mr. Grundy, who, respectively, were taking up posts with English Electric and at the Aeronautical Research Association wind tunnel.

Finally, Sir Victor said that the College's task was to get men of earning back to men of learning. The signs were good and this year twice as many entries had been received for the diploma course.

Sir Ewart Smith, technical director of I.C.I., proposed the Senior Common Room Society. There was an overriding need in this country for trained technologists, he said. The college was unique in its combination of academic and administrative staff.

Prof. J. V. Connolly, head of the Department of Economics and Production, who was in the chair, thanked Sir Ewart in reply and referred with regret to the departure of Messrs. Knight, Grundy, Judson, Gillmore, Lewis, Kellett and Huxley. He welcomed the new Warden, Mr. Palmer.

The final toast, that of the Guests, was by Sir Harold Roxbee Cox, Chief Scientist, Ministry of Fuel and Power. He did not think that the education of scientists was sufficiently broad and deep. Engineers needed two dimensions, breadth and height. The humanities should not be neglected. It was odd that at Cambridge today more were studying history than engineering.

Mr. David Keith Lucas, director and Chief Designer of Short Bros. and Harland, Ltd., pleased everyone with his picture of the staff and departments, for most of which he had parodied a nursery rhyme. "What are aeroplanes made of? Strings and stresses and other men's guesses. . . ."

"Civil Vulcan" Forecasts

ADDRESSING Manchester Rotary Club last week, Sir Roy Dobson, chairman and managing director of A. V. Roe and Co., Ltd., made some forecasts about the projected civil version of the Vulcan. It would, he thought, be capable of carrying passengers across the Atlantic at 620 m.p.h. and at a cost of a little more than a halfpenny per passenger-mile. The Atlantic might be crossed, from London to New York, in six hours westbound and less than five hours eastbound.

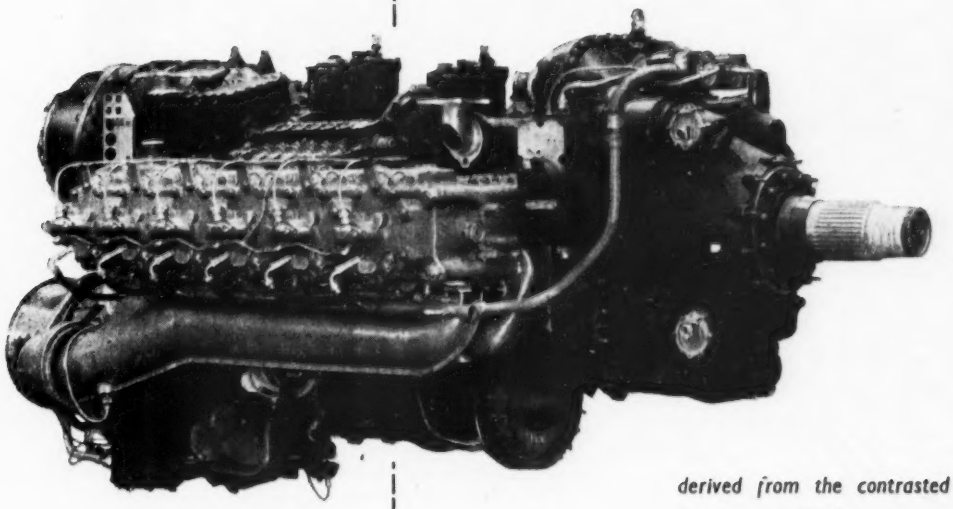
The new airliner would cost over £300,000 and would carry about 20 tons. Its operating costs, including crew and insurance, would be about eightpence a ton-mile.

Sir Roy forecast that in 20 years airliners with 200 people aboard would cross from London to New York in two and a half hours. He thought that by then military experiments with nuclear engines would be under way, but it would be a long time before they came to civil aircraft.

Mr. Churchill on a "Wanton Attack"

WHEN detailed information became available on the shooting-down of an R.A.F. Lincoln by Mig-15s near the zonal frontier in Germany (as reported in our pages last week), Mr. Churchill made—on March 17th—a statement in the House of Commons. After expressing the sympathy of the Government and of the House to the relatives of the seven aircrew who had died, the Prime Minister went on to speak of the "cruel and wanton attack by Soviet fighter aircraft" on the unarmed Lincoln.

compound interest—



derived from the contrasted characteristics of gas turbine and diesel engine—confers on the Nomad the best features of each type. Especially is this seen in the unique fuel consumption figures already established on test. Cruising consumptions over a wide range of altitudes and speeds are between ·33 and ·35 lb/ehp/hr., lower by far than any engine of comparable power. The simplified layout of the Nomad has led to substantial weight reduction—to the new figure of 3580 lb. (dry) for a take-off rating of 3135 e.h.p.

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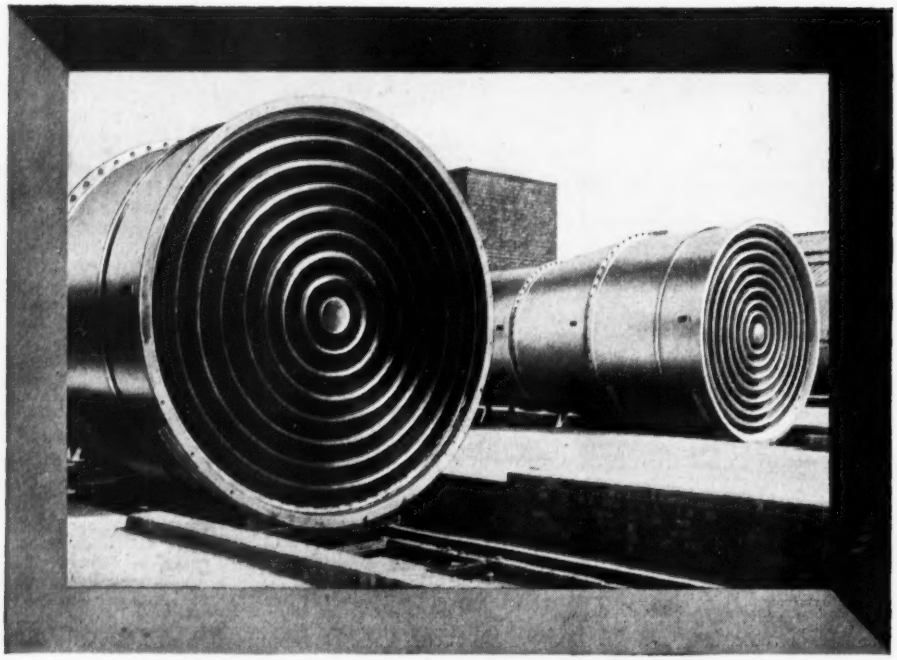

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FROM ALL QUARTERS . . .

He said that on training missions, when not engaged in gunnery practice, our aircraft had hitherto carried no ammunition. The Lincoln's belt-feed mechanism had, in fact, been removed from both Hispano 20 mm guns in the upper turret, as was the usual practice when it was not intended to fire these weapons. The 0.5in machine-guns in the rear turret were complete, but were not provided with ammunition. The Russians' assertion that the Lincoln opened fire on them is utterly untrue.

The flight was part of the usual exercising of Allied air defences. Such exercises had been carried out regularly by Flying Training Command over the past 18 months. The course prescribed for the Lincoln ran parallel to the zonal boundary and 40 miles on our side of it. The pilot and navigator were both fully trained and experienced officers.

A study of the information now available indicated that the aircraft might, through a navigational error, have accidentally crossed into the Eastern Zone of Germany at some point. But the evidence of ground observers, and the spent cannon-shell links from the Russian fighters picked up in our Western Zone, proved that the Russians repeatedly fired on the Lincoln and mercilessly destroyed it when it was actually west of, and within, the Allied zonal frontier. The wreck of the aircraft followed in its descent a track which caused it to fall just within the Russian Zone. Thus it was actually over our zone when first and mortally fired on, and the lives of seven British airmen were callously taken for a navigational mistake in process of correction, which could have been dealt with by the usual method of protest and inquiry.

British aircraft in the Western Allied Zone of Germany would continue to carry out their normal exercises, taking all possible precautions. Should Soviet aircraft stray into our zone every effort would be made to warn them, and, by following the procedure normally used by nations at peace, to avoid loss of life.

Mr. Arthur Henderson (Lab., Rowley Regis and Tipton) asked if the Russian case was based on the report of their pilots that the Lincoln fired first, and that the British case was that the Lincoln could not have fired, either because some guns were out of action or there was no ammunition for the others. As this evidence was vital as a complete refutation of the Russian allegations, why was it not included in either of the Notes handed to the Russian authorities by the High Commissioner at the week-end, especially because of the delay that was taking place in allowing our representatives to inspect the damage?

Mr. Churchill said that the full facts were not known when the first reply was made, but they had since been ascertained and were proven.

Mr. Henderson asked if every action would be taken to minimize the possibility of these long-range training aircraft from "drifting, possibly because of navigational error," near or over the East German border.

Mr. Churchill replied that all precautions would be observed.

On Thursday of last week, Gen. Chuikov, head of the Soviet Control Commission in Germany, proposed to Sir Ivone Kirkpatrick, British High Commissioner, that a conference be held in Berlin to discuss the question of air passage through the zones. In the Note in which the suggestion was made he rejected as "incorrect" the British protest about the shooting-down of the Lincoln; it is significant, however, that his statement contained the phrase, "I regret that the members of the crew of a British bomber lost their lives."

On the day on which the Prime Minister made his statement, reports were published in Washington of a new incident, this time off the east coast of the Russian peninsula of Kamchatka, where the Bering Sea joins the Pacific Ocean. A U.S.A.F. B-50, stated to be on a routine meteorological reconnaissance flight, was intercepted by two Mig-15s about 100 miles east of Petropavlovsk, on the southern tip of the peninsula. The fighters opened fire, and the B-50 returned it, but the engagement was then broken off; none of the three aircraft, apparently, suffered any damage.

Towards Profitable Aircraft Operation

"MAKING Commercial Aircraft Pay" was the title of the Royal Aeronautical Society's sixth Louis Blériot lecture, given by General Guy du Merle, F.R.Ae.S., on Thursday, March 19th. The lecturer was introduced by Mr. G. H. Dowty, F.R.Ae.S., president of the Society, who referred to his impressive experience as an engineer and pilot, and in senior posts of responsibility in the French Air Ministry, and mentioned also that he was the founder of his country's national civil aviation school.

The lecturer began by asserting that, now, aviation had truly come into its economic age. Louis Blériot had been a man of vision, and such men had laid excellent foundations for aviation; this year, fifty years after the Wright brothers' flight, was a good time to survey the past and eye the future. War-time developments in aircraft having been harnessed to peaceful pursuits, the prospects ahead were good, but the important factors of revenue and expenditure had always to be compared. The reaction to price variations was sensitive—if fares were high, traffic was low, and *vice versa*—and a reduction of the still-too-high fares in Europe was the first aim.

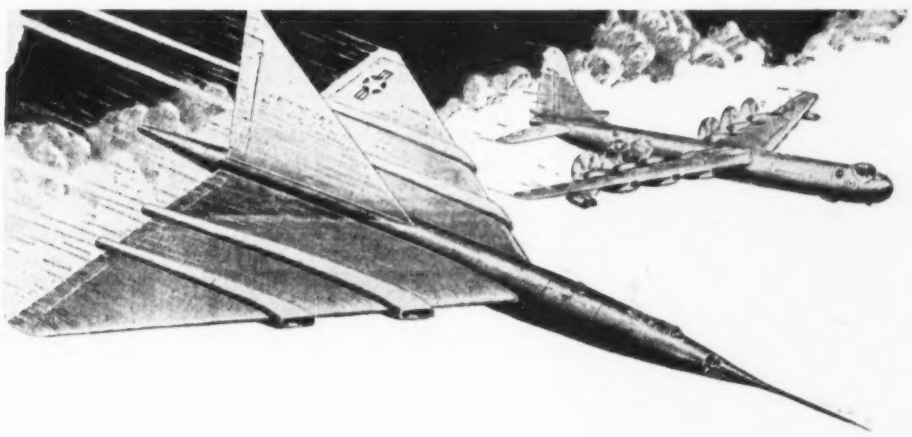
Total expenses, General du Merle went on, could be split up into five categories, but a straightforward analysis of aircraft types was difficult. He would consider only the direct operating costs which amounted to 60-65 per cent of total costs. The cost problem was intricate, but from first principles the inter-relation between the technical branches and design (aerodynamics, propulsion, structural design and equipment and installation), the aircraft, and various types of costs could be shown by means of diagrams.

The relationship of aircraft weight and performance to payload was basic, continued the speaker, who went on to state formulæ expressing take-off weight in terms of payload, aerodynamic factors and constructional efficiency. Based on these formulæ, graphs showing variation of gross weight with constructional efficiency were shown, and the effects of drag/lift ratios and headwinds were discussed. Payload/range graphs for various aircraft were then displayed, and the relationship between revenue and direct operating costs was studied. This technical approach, said the lecturer, could provide the hourly profit-earning capacity.

The effect of technical refuelling stops on the variation of revenue with distance was then illustrated. The important question of utilization was considered at length, relevant factors being basic design, maintenance, speed, versatility, flexibility, and flight refuelling.

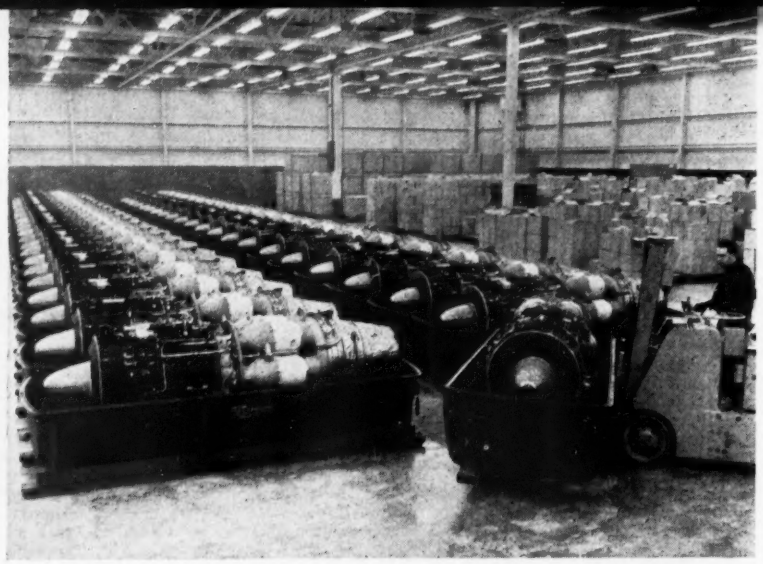
A comprehensive discussion of the questions of amortization, aircraft attractiveness, safety (which had to override other factors in profit-making capacity) and freight requirements was followed by the lecturer's main conclusions. These were that, although the profit-making capacity problem was intricate and gave an excuse for lack of criteria, that based on ton-miles flown was the best approach; and constant co-operation between operator and manufacturer was essential. In spite of the many difficulties, the final goal was extremely rewarding.

A vote of thanks to the lecturer was then proposed by Mr. Beverley Shenstone, M.A.Sc., F.R.Ae.S., A.F.I.Ae.S., chief engineer, B.E.A., who complimented General du Merle on his inspiring talk, and paid a tribute to the memory of Louis Blériot.



WHAT NEXT? Even modern schoolboys would be hard put to it to conceive aircraft more futuristic than some now building. The subject of this "Los Angeles Times" drawing is the Convair XB-58, known as the "Hustler," which is being developed against U.S.A.F. contract. It will be a supersonic bomber, with eight 10,000 lb-thrust turbojets; the engine disposition shown looks rather inefficient.

HERE AND THERE



POWER EN MASSE: These 45 Orendas, part of a month's production at the A. V. Roe Canada factory at Malton, Ontario, represent—say the makers—"sufficient power to propel eight ships the size of the 'Queen Mary'." The Orenda, which develops over 6,500 lb thrust, is being made for the CF-100 and the Canadair-built Sabres. Note the massive dirt-proof transport containers.

Light Fighters?

AIR support in the fight against the Mau Mau has been requested by the Kenya Government, and the matter is being considered by the Air Ministry. It has been suggested elsewhere that lightly armed trainer aircraft from one of the R.A.F. bases in Southern Rhodesia would prove sufficiently effective.

Keeping It Up

NEVILLE DUKE "went supersonic" in the Hawker Hunter on two occasions last week: one was at Blackpool, where Hawkers are shortly starting construction, and where the Hunter was informally demonstrated to the townspeople; the other was at R.A.F. Station, Duxford, on the occasion of the visit by Marshal Tito, as reported on page 392.

More About the Hinkler Ibis

IN *Flight* of February 13th we described how the Ibis light monoplane built in 1931 by Bert Hinkler, R. H. Bound and Basil B. Henderson had recently come to light near Southampton. It was purchased by Mr. H. C. G. Stisted, managing director of the Hampshire Aeroplane Club, and he has now decided to make it airworthy and study its production possibilities as a popular light aircraft. Mr. Stisted has been approached by the Australian Government, who want the machine—in which the log of Hinkler's 1928 Avian flight to Australia was found—as a museum piece; he has agreed to part with it eventually.

LETHAL BELT: In preparation for a "Jungle King" raid (see pages 390-391) a Lincoln at Upwood is loaded with an impressive amount of 20 mm ammunition for its mid-upper turret.

OUTSTANDING STORY

THE article on pages 402-405 of this issue, "A-roving by Hastings," tells the story of a return trip from Japan by two members of the staff of *Flight*, H. F. King and L. W. McLaren. During a remarkable six-week tour in Service aircraft, made with the full co-operation of the Air Ministry, they visited R.A.F. units at many points in the Middle East, Far East and Korea. They have brought back material and photographs for a unique series of articles, which, published at intervals, will lead up to a climax in our special number, THE QUEEN'S AIR FORCES, to appear on May 29th. In that issue, among many notable contributions, will be a memorable collection of colour photographs.

Korea Losses

FIGURES given by the Far East Air Force recently show that since the Korean war began in June, 1950, the Communists have lost 793 aircraft with another 141 probably destroyed, while the United Nations have lost 897, of which 716 were American.

Senior Officers Show the Way

THE 61-year-old C.O. of the Swedish Air Force, Gen. Bengt Nordenskioeld, last week landed a Vampire wheels-up on the airfield at Gothenburg after the undercarriage had jammed. A week earlier, A.V-M. T. C. Traill, A.O C. No. 19 Group, Coastal Command, had force-landed an R.N. Firefly which he was flying from St. Merryn. Unlike the Swedish officer, who was unscathed, A.V-M. Traill suffered minor injuries.

Employment in the Industry

IN the House of Commons recently Mr. Maurice Edelman (Lab., Coventry N.) asked whether the expectation contained in the *Economic Survey for* 1952 that 50,000 additional workers would be wanted for the aircraft programme by this month had been fulfilled, and how far the demands for labour were being satisfied. Sir Walter Monckton, Minister of Labour, replied that changes in the defence programme had reduced to some extent the number of additional workers required for the aircraft industry by March 1953. Between the end of 1951 and last January, employment in the manufacture and repair of aircraft increased by 32,000 and unfilled vacancies decreased from 8,500 to 5,300.

Yeovil to Yugoslavia

UNDER the Mutual Assistance programme the U.S. Air Forces in Europe have placed an order with the Ministry of Supply for Westland-Sikorsky S-51 helicopters to the value of nearly a million dollars. They will have P. and W. engines supplied by the U.S. Government, and delivery will begin in the autumn.

College of Aeronautics Election

AFTER the Cranfield Society's dinner (reported last week), the annual general meeting was held, at which Mr. T. M. Corson was elected to the committee, and Lt. Cdr. Monk, Mr. J. Lynall, and Mr. J. J. Spillman were re-elected as chairman, secretary and treasurer respectively.

Brancker Lecture: New Date

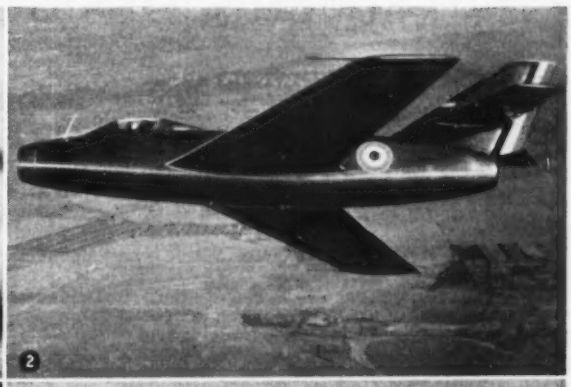
THE Institute of Transport announces that the 1952 Brancker Memorial Lecture —arranged for February 9th and postponed because of the illness of the lecturer, Sir Frederick Handley Page—will now take place at 5.45 p.m. on Wednesday, April 15th in the Jarvis Hall, 66, Portland Place, London, W.1. Sir Frederick will speak on *The Influence of Military Aviation on Civil Air Transport*. The meeting will be open to visitors.

Temco Acquire Luscombe

THE Luscombe Aircraft Corporation, of Garland, Texas—makers of the Luscombe Silvaire—has been wholly merged into Temco Aircraft Corporation, of Dallas, Texas. Temco—manufacturers of the TE-1 Buckaroo and other trainers—acquired a majority holding of Luscombe stock in March 1950. Latterly, Luscombe output has been confined to B-36 subcontract work.

DASSAULT FIGHTERS

1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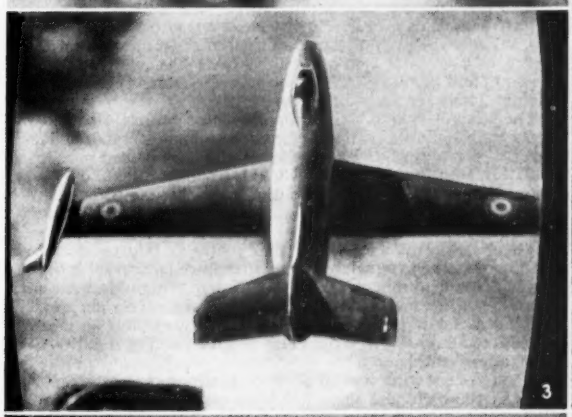
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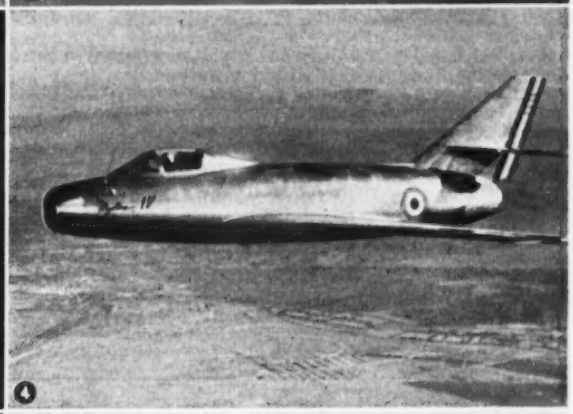
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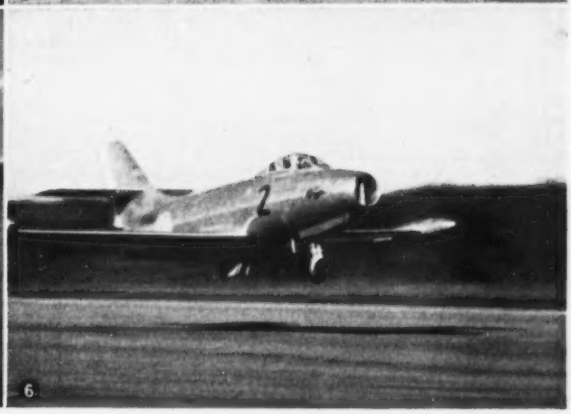
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PERHAPS, owing to the atmosphere of so many past *Expositions de l'Aeronautique*, the French are often thought of as manufacturers of prototype aircraft which never herald a production line. Such criticism is now less valid, for several French organizations have now made valiant—and successful—efforts at contributing materially to the defence of Western Europe.

Without doubt the greatest of these efforts has been made by the private (i.e., not nationalized) company of Marcel Dassault. This firm is in full production with fighters, entirely of their own design, considered equal in merit to contemporary aircraft of any other country.

The main design-office is at St. Cloud, near Paris, and fighter production and assembly takes place at Agenteuil and Merignac respectively. Development-testing is largely done at Mélun-Villaroche and, in addition, the company have another plant at Talence, where over 300 twin-engined Flamant transports were built.

The first M.D.450 Ouragan (Hurricane) appeared in 1949 as a straight-wing, very conventional design, powered by a Hispano Nene. Current production, which will soon taper off, is of a developed version with a Hispano Tay, without afterburner. Some 350 are to be built, and production approximates to 20 per month.

The Ouragan—shown in photographs (1), (3), (6) and in the rear of (5), above—is fully pressurized and has a Martin-Baker ejection seat. Armament is four 20 mm cannon. Several experimental aircraft have been developed from the basic type, including radar-equipped two-seaters with side intakes.

The M.D.452 Mystère, which is now taking over floor space from the Ouragan, has 40 deg of sweep and considerably more power. The engines fitted in production aircraft include the Tay and the Atar 101D, both with afterburner, of some 8,000 lb thrust. Armament and equipment remain generally as before.

The Mystère has been evaluated by M.S.A. teams under Gen. Albert Boyd and, as a result, considerable dollar backing has already been allocated towards Mystère production. Present orders total 340 plus an undisclosed number for general N.A.T.O. use; some dozens have already been built.

In the hands of both French and American pilots, the latest prototype—the Mystère 4, seen in views (2), (4) and in the front of (5), above—has been supersonic. The photographs, incidentally, are from a Mutual Security Agency film, parts of which were shown recently on the B.B.C.'s *Television Newsreel*.

High-speed Considerations

Points from S/L. Waterton's R.Ae.S Lecture

S/L. W. A. Waterton

LAST week we made a brief reference to the lecture, entitled *Some Aspects of High-Performance Jet Aircraft*, delivered by S/L. W. A. Waterton, G.M., A.F.C., as a Royal Aeronautical Society "main" lecture before the Derby branch of that institution on March 12th. It is now possible to give a more detailed summary.

After a brief introduction, S/L. Waterton—who is chief test pilot to the Gloster Aircraft Co., Ltd.—first recounted some of his war-time experiences in evaluating Allied and hostile aircraft by means of actual combat trials. He pointed out that discrepancies between theoretical and actual performance had frequently arisen, such as the high angle of climb of the Ju 88—which caused pursuing fighters of higher *rate* of climb to stall out—and the immensely rapid rate of roll of the Fw 190, which permitted it initially to out-turn a Spitfire.

In general, went on the lecturer, the basic requirements of a fighter were performance, stability and ease of control—together with vision, comfort and security for the pilot. With the recent enormous increases in operating speeds and altitudes and—notably—rate of change of conditions, the problems for the designer and the pilot had increased immeasurably.

By way of illustration, S/L. Waterton enumerated some of the difficulties that were encountered in aircraft of present-day performance. They included variations in stability caused by altitude, by low or very high air speeds, and by increased engine power—and also by aeroelastic distortion or up-and-down float of controls; lack of control damping at high altitudes; and difficulties caused both by change of control-hinge moments with speed and by lack of effectiveness and self-centering at high speeds. One result of all these variables, for the moment at any rate, was that powered controls appeared to be an essential—though the danger of the brute force so applied lay in the fact that it could cloak a great deal of ignorance.

S/L. Waterton then moved on to the subject of supersonic and transonic flight, stressing at once that, except with rocket-powered aircraft, such velocity was attainable at the present time only in relatively steep dives—though, doubtless, improvement in this respect was on the way. The difficulties to be met were, of course, those of drag increase, lack of stability and variations in control at the high Mach numbers concerned; he gave an outline of the actual phenomena that could occur, separately or together. Broadly speaking, these were numerous and very unpredictable at high subsonic speeds, particularly in the range 0.93 to 0.97 indicated Mach number, but largely disappeared thereafter, except for lack of effectiveness of the elevator control. This had made it necessary to utilize not only powered controls, but also irreversible controls and moving tailplanes.

The lecturer had something to say on the distinction between rate of climb and angle of climb. In the Gloster Javelin—one of the latest types with which, as a test pilot, the lecturer has been concerned—both are of a high order. In this striking photograph, taken from the ground, it will be noticed that the undercarriage is not yet fully retracted.

Another striking point was the immensely favourable effect which local cleaning-up in design could have on critical Mach number. The same applied to the elimination of avoidable irregularities in the airframe, regardless of whether these were due to too great tolerance in manufacture or careless handling by ground crews. S/L. Waterton gave a whole series of examples to illustrate his contentions, and finished this section of his lecture by querying whether there was not much to be said for constructing future aircraft with heavier skins and "less light internal tinmongery" to provide more accurate surfaces.

The next major point to be discussed was aircraft configuration in relation to the performance required. The lecturer outlined the merits of low wing-loading coupled with adequate power and strength, and then went on to consider the relative advantages of straight, swept, crescent and delta wings.

The straight "plank" wing provided good control, stability and structural possibilities, possibly because so much research had been devoted to it and so much experience had been gained over many years. In addition, if it were made thin enough it could offer good transonic and supersonic possibilities, but only with penalties such as loss of space, severe structural problems, and an increase in wing loading.

The swept plank wing could offer a notable improvement over the straight wing of equal thicknesss in drag-reduction at high speed and high Mach numbers and in lift coefficient at high Mach number. It could provide reasonably good transonic and supersonic capabilities. It suffered, however, from structural problems, particularly in torsional stiffness, in weight and in space, and in stability, both longitudinal and lateral.

The crescent wing was an effort to combine the root characteristics of the delta and the outer wing features of the straight or slightly swept plank wing. Theoretically, this was admirable from aspects of stability and control, but it was difficult to see how it could possess the space and structural advantages of the pure delta, since it had neither the chord of the latter nor the average thickness/chord ratio. In achieving a better span-loading it needed to be of greater span or less chord than the pure delta; thus further structural advantage would be lost, save by resorting to less area and so going to a higher wing loading, which might well negate its advantages.

The delta plan-form did appear to provide an extremely reasonable and promising compromise in offering a number of features in which the previously mentioned forms were lacking : (i) Excellent Mach number characteristics as to change of longitudinal trim and rise of drag due to Mach number; (ii) Low high-speed drag; (iii) A compact form, of sufficient strength to cover high indicated air speeds; (iv) An internal volume providing space for the masses of fuel, ancillaries and equipment with which modern aircraft were burdened; (v) High development potential.

The lecturer then quoted other reasons which caused him to favour the delta plan form, and explained how a tailplane had been incorporated in the very-high-speed Javelin, whereas it had not been considered necessary for the relatively slower Vulcan—thus reducing drag, weight and complexity.

Leaving the question of aircraft design, S/L. Waterton next discussed the "vision barrier"—the catch-phrase which currently related to vision difficulties at altitudes of 40,000ft and upwards. These difficulties were very real, and included glare, excessive ultra-violet radiation, lack of contrast and of reference points, and reduced ground vision due to "blind" areas. Other points were the continued change of focus for the eyes between watching instruments and searching the sky, the reduction of maximum sighting distance between aircraft to seven or eight miles and, especially in poor visibility, the very short times available for sighting both landmarks and other aircraft.

Turning then to economics, the lecturer pointed out how the promise of simplification with the advent of jet power had quite failed to materialize. Undercarriages, for example, were just as

long; there were air-brakes and powered controls; and a whole host of electrical gadgets had arrived to worry the servicing personnel on the ground and cause failures—and even fires—in the air. Instruments were also more numerous than ever before, and the lecturer asked for an improvement in their presentation, together with the grouping of red and amber warning lights in a position where their message could not fail to be seen at the earliest moment —namely, directly in front of the pilot. Finally, the range and complexity of components in modern aircraft was already too large for economy's sake—could not something be done to create a greater range of standardized parts?

S/L. Waterton concluded his lecture with a series of general comments on the effect of meteorological conditions on the modern high-speed aircraft.

JOINT ECONOMICS

ONE of the most important claims made—with justification—for the Redux ("Research at Duxford") metal-to-metal adhesive process is that it gives a joint that is stronger than one, of similar dimensions, which is riveted or spot-welded. The inventor, Dr. N. A. de Bruyne, who is managing director of Aero Research, Ltd., of Duxford, Cambridge, has recently been to America, where he visited and spoke before some forty aircraft companies and institutions. On his return recently he gave a short talk at Londonderry House, opening with a comparison of the structure-weight of the de Havilland Comet 1 (which makes extensive use of the Redux process) and an imaginary "Comet Mark N.G." using standard riveted construction. The figures he discussed were as follows :—

Dr. N. A. de Bruyne.

	Comet Mark 1	Comet Mark N.G.
Empty weight (per cent) ...	45	48
Fuel weight (per cent) ...	42	42
Payload (lb)	14,000	14,000
Fuel load (lb)	44,000	58,000
Empty weight (lb) ...	47,000	66,500
Gross weight (lb)	105,000	138,500

Dr. de Bruyne said that, by using a simple analysis due to Dr. Russell of the Bristol Aeroplane Company, the figures under Comet Mark N.G. resulted if the empty-weight ratio was pushed up to 48 per cent, while retaining the same performance as the Comet 1. The actual addition to the empty-weight figure was 19,500 lb, and thus this small 3 per cent increase had resulted in a much heavier and more powerful machine and one which would cost the purchaser £175,500 more (on the basis of £9 per lb weight). This was only the beginning of the trouble : on figures given by Mr. Peter Masefield, the annual operating cost would be increased by £50 per lb and this amounted to nearly £1 million a year. Dr. de Bruyne said that it was perfectly clear that the Comet N.G. would find no buyers and he believed that, had Redux not been used, the Comet's empty-weight percentage might well have been 48 or even more.

Another example which might be quoted is that of the Bristol Britannia, into which Redux was introduced when the design was already well advanced. Even with a comparatively small-scale use of Redux, 1,000 lb in structure-weight had been saved. Dr. de Bruyne added that Redux would do more than save weight; it simplified pressurization and enabled smooth surfaces to be obtained. It produced integral, not "sewn-together," structures; hence the great increase in static strength.

Redux, which was first adopted by the de Havilland Aircraft Co., Ltd., has been a purely British development. A patented process, it is extensively used by the Chance Vought company, but, said Dr. de Bruyne, the process was not used in the United States by other firms to the extent that it should be.

After making further comments on his American tour, Dr. de Bruyne remarked that all generalizations were false; but, bearing that in mind, the British use of Redux had been much more imaginative and bold than anything he had seen in the U.S.A. This might be because the hard economic facts of jet transport had not yet struck them. On the other hand, he had seen metal honeycomb constructions in pilotless aircraft which appeared to be superior to anything done in this country. He referred to the high-speed band-saw method of shaping honeycombs. Some of the American bonding techniques were very ingenious. "Although we have nothing to learn from them about adhesives," said Dr. de Bruyne, "I *have* learned something about techniques of applying pressure and of assuring smooth surfaces."

The interior of the Comet fuselage-structure, where Redux bonding dispenses with the use of thousands of rivets in skin and stringers, thus saving man-hours and simplifying the problem of pressurization.

EJECTION AT 30,000ft.

AN important new step towards complete safety of ejection and descent from high-speed aircraft at very high altitudes was taken on March 17th, when Mr. Bernard Lynch was ejected from the back seat of a Meteor at approximately 30,000ft. Having got clear of the aircraft, we are told, he stayed in the seat, under automatic release-control, until the harness was freed and he was lifted out by his parachute. Mr. Martin, of the Martin-Baker Company, mentioned that there has been a lot of argument about the feasibility of gliding a seat down from 30,000 or 40,000ft. It was said that seats would spin and all kinds of things would happen to them. In fact, the seat did not spin, but came down turning round very slowly. Mr. Martin believes that this is the first time in the world that a seat has been ridden down in this way.

Before Mr. Lynch's live drop, a number of tests had been carried out with dummies from heights between 30,000 and 40,000ft, and these had worked out well.

There are two types of tests which are considered important—the low-altitude test at about 500ft and the high-altitude one which has just been carried out. Dummy tests from 500ft have indicated that the canopies open with as much as 300ft to spare. This is a great improvement over the ordinary Mark 1 seat now in service with the R.A.F. The Martin-Baker company are now making conversion sets comprising additional equipment for attachment to the standard Mk 1 seat to convert it to the fully automatic type. In this way the R.A.F. will be supplied with seats up to the latest standard as quickly as possible.

Development of the new seat was described in a lecture by Mr. Martin, reported in *Flight* of November 14th, 1952.

CONTROL OF PYTHON POWER

Fuel and Airscrew Systems of the Wyvern's Turboprop

THE provision of a satisfactory single-lever power control for turboprop units was recognised as a "must" during the earliest stages of development. The first turboprops to fly were the experimental Rolls-Royce Trents installed in a Meteor 1 airframe, and until the relationship between pitch and power had been studied, the pilot had some rather exciting experiences. By mid-1947 a reasonably satisfactory system for the control of the Trents had been devised, and regular readers may recall some notes, on the handling of these units in the air, published in *Flight* of March 18th, 1948.

At the end of 1948, Mr. W. H. Lindsey, then assistant chief designer of Armstrong Siddeley Motors, Ltd., and now chief engineer of that company, read a paper before the Royal Aeronautical Society on the development of the Mamba. In it he explained in detail the problems of turboprop controls. He said that the turboprop introduced a new independent variable into the control system. In the simple jet engine with fixed propelling nozzle, the rotational speed of the engine was determined by the amount of fuel supplied, and this alone had to be controlled. When power was delivered to a variable-pitch airscrew the rotational speed of the engine could be varied for a constant fuel-flow by altering the pitch of the airscrew, and hence the power it was capable of absorbing at a given rotational speed.

In 1949 we were again able to try out and describe a turboprop control in the air, and in this case the Mamba-powered Balliol was the aircraft (*Flight*, February 3rd, 1949).

Today, turboprops are going into civil and military service—Darts for B.E.A.'s Discoveries and the much larger axial-compressor Armstrong Siddeley Pythons for Wyvern strike aircraft for the Navy. So far Wyverns are approved for operation from airfield runways; for the more exacting conditions of carrier operation, clearance is awaited. There follows a description of the power and airscrew controls employed for this unit.

Fuel System.—Fuel is supplied by a Lucas pump to the barometric flow control, which governs the flow by means of a servo fuel pressure. This pressure acts on the servo piston in the pump, in order to regulate the stroke of the pump piston. The servo pressure is controlled by the pilot's throttle and also by barometric pressure acting on an aneroid. Fuel is then delivered under pressure to the distributor, which incorporates the H.P. cock, and thence to the eleven burners. Although the fuel system components in general follow normal turbine-engine practice, a brief description may be given here.

The fuel pump is of piston type, with swashplate-controlled variable delivery. The swashplate position, and thus the pump delivery, is controlled by a servo piston operated by fuel pressure from the flow control. The overspeed governor, which restricts the fuel supply should the engine speed exceed 8,300 r.p.m., consists of a diaphragm operated by fuel pressure. Diaphragm movement reduces the servo pressure, which in turn reduces pump delivery.

The Armstrong Siddeley barometric flow control, or barostat, applies a spring load to a diaphragm—by means of a servo piston and "follow-up" rotary valve arrangement—whenever the throttle is moved. The resulting diaphragm movement changes the position of a valve, which increases the servo pressure and hence the delivery of fuel from the pump.

This increased fuel-delivery increases the pressure-drop across a number of small holes. The pressure difference acts across the diaphragm and, when equilibrium is reached, returns it to its neutral position.

As altitude is increased, the barometric control tends to reduce the effective number of small holes, and so increases the pressure difference across the diaphragm. This causes a reduction in fuel delivery, due to the decreased servo pressure.

In the distributor unit is incorporated a high-pressure cock controlled from the cockpit. During conditions of low fuel-flow, a pressure-increasing valve is used to increase the operating pressure of the fuel system. The distributor piston is designed to ensure an even distribution of fuel to each of the eleven low-pressure vaporizing type burners, *via* the main jets, which are situated in the distributor.

Anticipator.—In order to obtain rapid airscrew-pitch changes to cater for power changes caused by throttle movement, the

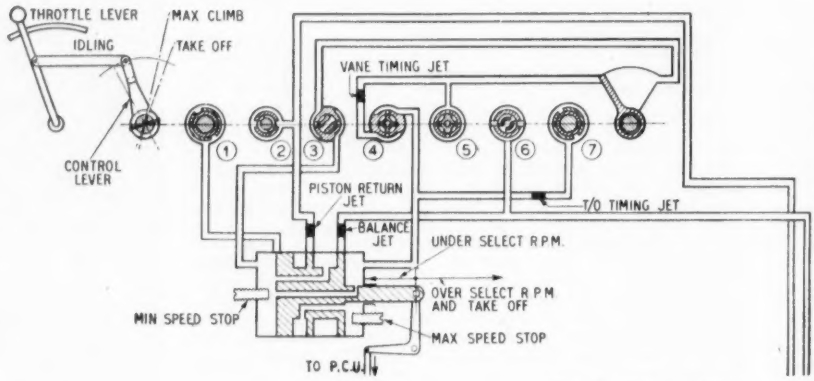


Fig. 1. The anticipator consists of two long concentric rotary valves, the porting arrangements of which are here shown diagrammatically. *(See description on page 399.)*

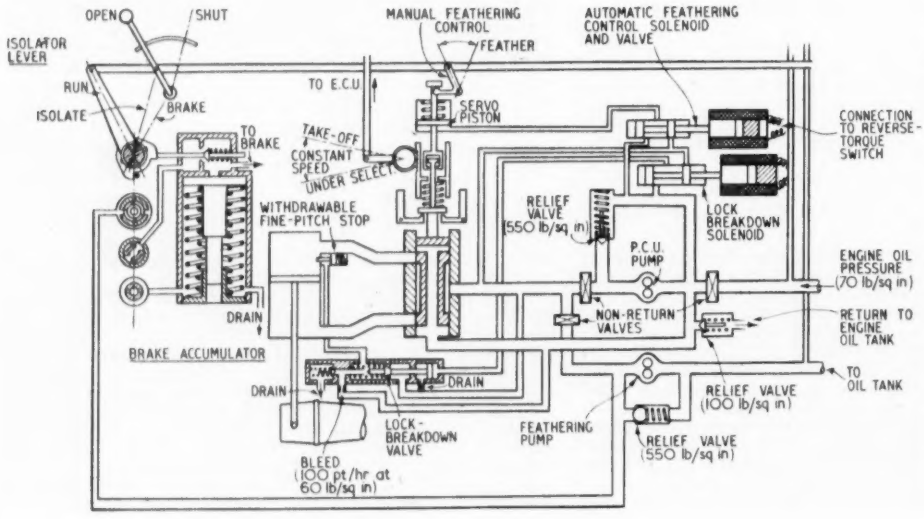
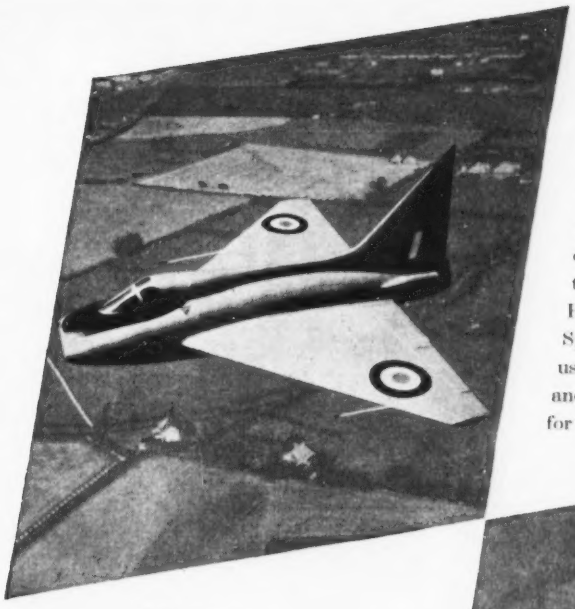


Fig. 2. The Python's propeller control unit. Selection of governed r.p.m. is by means of the anticipator lever, and the hydraulic brake prevents ground windmilling of the contra-rotating airscrew.

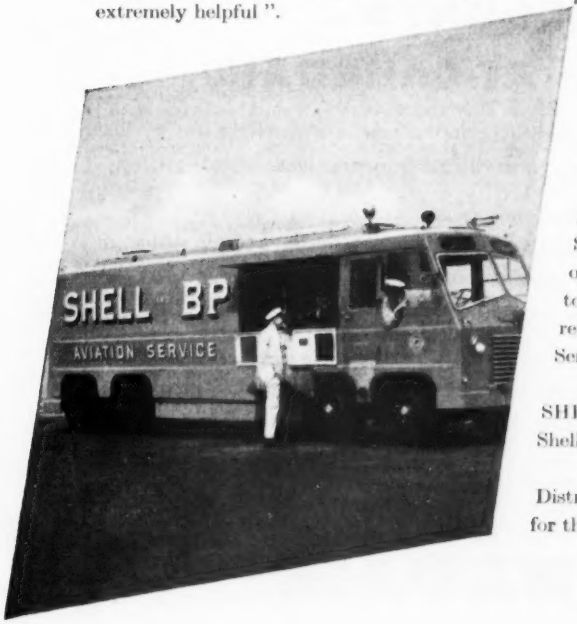


The aeroplane

The Boulton Paul P.111. A highly unconventional delta-wing machine designed for research into the effects of the mysterious 'sound barrier'. Rolls-Royce Nene turbo-jet engine. Span : 33′ 6″, length : 26′ 1″. Boulton Paul used fuel supplied by Shell-Mex and B.P. Ltd. and AeroShell lubricants for the P.111's experimental flights.

the pilot

At only just 29 years old, Glasgow-born Alexander Gunn of Boulton Paul is by far the youngest chief British test pilot. Over 900 of his 1,500 flying hours have been clocked on tests — a good many of them in the P.111, which he considers his special ' pigeon '. Joined R.A.F. from school in 1942, Wings 1943, active service in fighters for next two years. Is very modest about his successes over Belgium and Holland during this period. With Boulton Paul since 1949. Says he finds Shell and BP Aviation Service is " always extremely helpful ".



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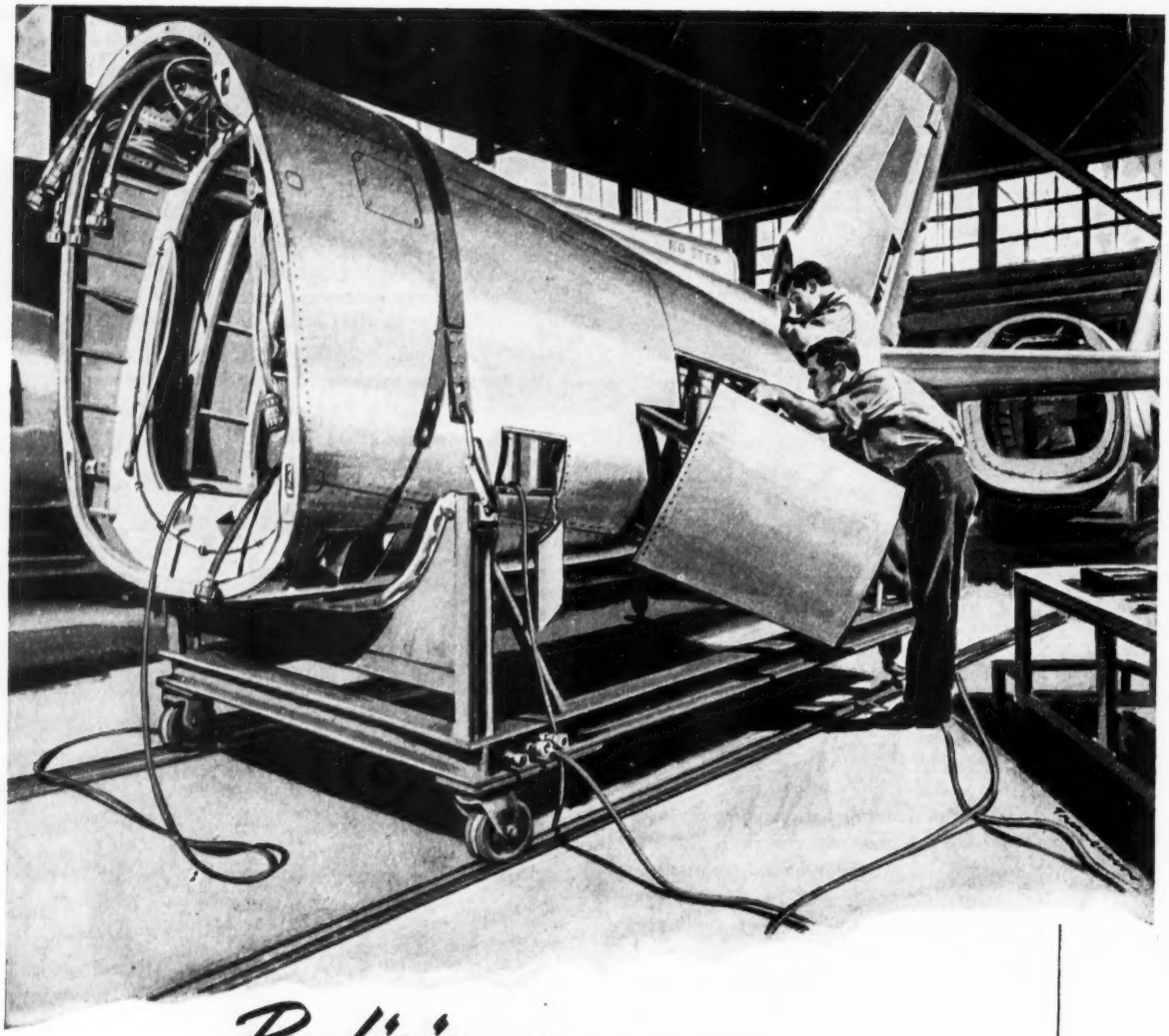

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CANADA—AIR LAND

The Saskatchewan Power Corporation in Canada has recently awarded contracts to four flying concerns for aerial patrols of its power lines.

Reports received by the corporation from the pilots on patrol give the exact location of trouble, enabling maintenance crews to remedy the situation quickly. Flying at about 60 miles per hour, it takes approximately 125 to 150 flying hours to cover all the corporation's lines in the province.

The use of aircraft has become an established part of Canadian life, and as Canada's frontiers continue to expand, aircraft play an increasingly active part in the maintenance of her vast domain and way of life.

CONTROL OF PYTHON POWER . . .

anticipator was introduced. It is connected to the pilot's throttle, and a brief description of its functions follows.

During steady running, except at full throttle, the link from the anticipator to the constant-speed unit control-spring is held in a neutral position, allowing the unit to control at 7,800 r.p.m. When the pilot's throttle is opened, the anticipator lever moves, decreasing the load on the spring, and so reducing the selected r.p.m. to, say, 7,700 for a short period, after which the lever returns to its neutral position.

This under-selection of r.p.m. therefore coarsens the airscrew-pitch as the engine power rises, so maintaining an approximately correct relationship between engine power and airscrew-pitch, and maintaining approximately constant r.p.m.

When the throttle is closed, the anticipator lever moves in the reverse direction, and temporarily causes an over-selection of r.p.m.

When full throttle is applied, as on take-off, the anticipator first under-selects r.p.m., as described above, but instead of returning to the neutral position, the piston continues to move to the maximum-speed stop, and so selects 8,000 r.p.m. on the propeller control unit governor spring.

The actual anticipator unit comprises two long concentric rotary valves, the porting arrangements of which are shown diagrammatically in Fig. 1. Movement of the inner valve is controlled directly by the throttle, while the outer valve follows-up the inner one by means of an attached vane. The oil supply to either side of the vane is controlled by the porting of the valves and by the vane-timing jet.

The relative positions of the two valves during and after a throttle movement open appropriate ports which pass oil to the anticipator piston. This action momentarily over- or under-selects r.p.m. immediately following a movement of the throttle. When the vane has moved the outer valve to coincide with the inner valve, or throttle position, its movement stops and the piston can return to its neutral position.

When the throttle is moved to the fully open position, an additional port is opened, causing the piston to move to the maximum speed stop and remain there. Rate of movement of the piston in either direction is controlled by the piston return jet and the balance jet. Oil supply for the anticipator is obtained from the engine oil pump and returns to the oil tank.

The porting of the valves is as follows:—

(1) Pressure supply to piston, opening only at full throttle and when vane has also reached full travel.

(2) Pressure supply from oil pump, feeding along valve to ports numbers 1, 3, 4 and 5.

(3) Supply to, or scavenge from, vane, depending on whether throttle is respectively closed or open.

(4) Supply to, or scavenge from, vane, depending on whether throttle is respectively open or closed.

(5) Additional supply or scavenge to port number 4, by-passing the vane timing-jet. This speeds up movement of the vane if throttle is moved rapidly, so that under- or over-selection is not held too long.

(6) Scavenge return from ports numbers 3, 4, 5, 7.

(7) Scavenge from piston while piston is moving to maximum r.p.m. condition at full throttle position of throttle and vane. The flow is controlled by the take-off timing-jet.

It will be seen from the diagram that the piston possesses internal passages permitting an oil flow through the piston while the anticipator is in operation. Thus a sensitive movement can be obtained without the use of very small jets, and control of adjustment by jet-size variation is more practicable.

Airscrew Control.—The propeller control unit is basically the same in operation as the ordinary constant-speed unit. Oil is obtained from the engine oil pump and is boosted by the p.c.u. pump. This oil is fed to the centre of a two-way valve which is controlled by governor weight and a spring, and which enables oil to pass to either side of the propeller piston. During steady running (except at idling or full throttle) the governor controls the r.p.m. at a constant 7,800 as previously described.

The Python installation has, however, four special features. Firstly, selection of governed r.p.m. is solely by means of the anticipator lever, and the pilot has no direct control over the r.p.m. selection. Feathering of the airscrew can be performed mechanically by movement of the high-pressure cock, or by an electrically-operated servo piston which is energized by reverse torque on the engine. Thus immediate feathering is ensured in the case of power failure.

A third refinement is the fine-pitch stop which, should the p.c.u. fail, prevents the airscrew from moving to an excessively fine pitch-angle in flight. The stop is withdrawn hydraulically on lowering the undercarriage, when a solenoid-operated valve is energized. To prevent airscrew-windmilling on the ground, an hydraulic brake is fitted. This is fed by the feathering pump and is held "on" by a spring-loaded piston acting on oil in an accumulator.

In addition to these features, a recent modification to the propeller control unit is the inclusion of an acceleration-sensitive device. This gives a bias to the p.c.u. valve by an amount depending on the rate of change of engine r.p.m. at any given instant. Its purpose is to improve the stability of the system, and so prevent excessive oscillation of r.p.m. following rapid throttle movements.

HELICOPTER PILOTS' DISCUSSION

SUMMARIES of the three main papers read to the meeting of the Helicopter Association on March 6th appeared in *Flight* of March 13. Mr. C. T. D. Hosegood, of the Bristol Aeroplane Company, related his test-flying experiences and showed a film of the early flights of the Bristol 173 Mk 1; S/L. W. R. Gellatly, of the Aircraft and Armament Experimental Establishment, spoke on some aspects of high-altitude and instrument flying as applied to helicopter requirements; and Capt. J. A. Cameron of B.E.A. put forward the civil operators' point of view.

Before inviting general discussion, the chairman, W/C. R. A. C. Brie, mentioned two points upon which he would like some enlargement; the degree of danger in autorotation at high altitude; and the value of the castoring undercarriage on the Bristol 173. He then read a contribution sent in by Mr. J. N. Dennis of the Fairey Aviation Company, who was unable to be present.

It was Mr. Dennis's contention that as little tethered ground-running as possible should be carried out when testing a prototype, as resonance could be felt building up. Free flight had to be faced at some time. The aircraft might not be subject to resonance during the tethered condition but this did not necessarily mean that it would not break into resonance when free. He also made a plea to all concerned in cockpit layout to "soft-pedal" in the matter of vision requirements. He preferred the WS-55 type of layout to a Perspex globe.

Mr. J. S. Fay, of Westland Aircraft, Ltd., referred to his experience of instrument flying in the "manually-controlled" S-51 fitted with fabric-covered blades. With the artificial horizon obscured safe control was not possible, but the "hydraulically-controlled" WS-51, with metal blades, showed a marked improvement in handling characteristics and stability, and should be less tiring to fly on instruments. Endorsing Capt. Cameron's remarks regarding the lengthy engine warm-up period, he said that the time wasted in this way in a training school was equivalent to 7 per cent of the aircraft utilization. On the question of ice-accretion he cited a recent example in which he had found clear ice on the inner third of the main and tail rotor-blades. It took place while hovering near the ground in foggy weather, and was 1/10th of an inch thick on the leading edges after a five minute flight. He thought a de-icing system was required.

Endorsing S/L. Gellatly's opinions regarding the requirement for freedom of flight at all altitudes and in all weathers, Mr. J. S. Shapiro wondered whether his reference to increased sensitivity with increased altitude should not have been "decreased sensitivity." The aircraft did not obey control as well as the pilot was accustomed to in a low-level flight. He also mentioned experiences, with the Air Horse, similar to those of Mr. Hosegood, although no ground resonance attributable to the undercarriage was encountered. A similar vibration had appeared, however, the frequency of which—after rectification of a mistake in the determination of structural stiffness—was found to be close to that predicted.

In a few appreciative comments on the papers presented, Mr. E. L. Bird, of the Bristol Company, welcomed the opinions and criticisms from the test pilots.

The main speakers then replied. First was Mr. Hosegood, who considered himself lucky to have only one query, and that (from the chairman) concerning castoring undercarriages. The 173 Mk 1 had the two front wheels castoring independently but that was not altogether satisfactory. In the Mk 2 they would be kept castoring together by means of a tie-rod.

S/L. Gellatly assured the chairman that there was no danger in autorotation at altitude. The danger at height was in the transition period in the event of an emergency power-failure. Some pitching tendency might be induced, and accentuated by the big change in position-error. He said he had not noticed any of the inconvenience—mentioned by Mr. Dennis—arising from "too much Perspex around the cockpit". Flying a helicopter at 15,000 to 18,000ft was similar to handling a jet fighter at 40,000ft, he thought, and he confirmed that sensitivity was increased with increase of height.

There being no questions to be answered by Capt. Cameron, the meeting closed with a vote of thanks proposed by the chairman.

HELICOPTER NOISE

Results of "South Bank" Tests

SOME enlightening information on helicopter external-noise levels, and also on the noise of jet aircraft, has lately been made available by a firm of scientific-instrument makers who have been associated with the recent B.E.A. helicopter experimental flights to and from the South Bank Exhibition site in London.

It will be recalled that one of the principal objections to the use of the site as a rotorstation has been the possible effect of noise penetrating to the London County Council offices in the adjoining County Hall. At the suggestion of a London newspaper, the firm concerned—Dawe Instruments, Ltd.—provided the services of a technician equipped with one of their standard Type 1400 sound-level meters, so that objective readings of the noise-level of a B.E.A. S-51 could be taken.

Introducing their report, Dawe Instruments remark that noise is a very difficult phenomenon to measure. In the first place, the *energy* of sound is quite insignificant—for instance, 250,000 people talking at the same time would barely produce the sound-energy equivalent to the electric power required to light one 5-Watt bulb. Furthermore, the range of sound intensities with which the human ear can deal is astonishing: taking the threshold of audibility as 10^{-16} Watt/sq cm, and pain level as 10^{-4} Watt/sq cm, this represents a variation by a factor of 1 billion (10^{12}). The frequency of audible sounds ranges from about 25 c.p.s. to about 18,000.

The human ear is not equally sensitive to all noises. A high-pitched note will sound louder to the average ear than a deep note of the same intensity. By providing suitable weighting networks, the response of the Dawe sound-level meter has been so adapted in relation to the human ear that its "hearing" will differ less from that of the average listener than two listeners may differ from each other in any given group.

The instrument is calibrated in decibels, the decibel rating of a sound corresponding roughly to its subjective effect on the human ear. The range covered is from 30 to 130 db. By way of a comparison, the rating of a very quiet countryside would be 35 db, while an underground train rates about 108 db. The threshold of audibility lies at 0 db, while a noise-level of 120 db is generally considered to be so loud as to be painful.

The general noise-level in the street which runs between County Hall and the South Bank site down to the river was found to fluctuate around 48 db, depending on the volume of traffic in the nearby streets. Cars passing the operator at the test point, at a distance of about 20ft, raised the level to 70-72 db. When the S-51 was circling overhead, at a height of about 1,000ft, the instrument registered 62 db.

The greatest amount of noise is obviously made during the take-off. A reading of 98 db was shown at the moment when the accompanying photograph was taken, during one of the four take-offs.

Inside County Hall, conditions were, of course, very much different. A first-floor committee-room facing the South Bank site was selected as test point. With no one in the room talking or moving, and with no noise from the corridor immediately outside, the general noise-level, with the windows closed, was about 42 db—approximately equivalent to the noise-level of a quiet home.

A reading of 98 decibels was being shown by the instrument (carried by observer in foreground) at the moment when this photograph was taken.

The aircraft passing overhead sent the meter needle up to about 56 db, while during the take-off the instrument registered 79 db.

Incidentally, the noise-level measured in the Dawe offices at 83 Piccadilly on the same afternoon, also on a first floor, gave a reading of no less than 82 db. In this case, too, all windows were closed and no noise was made inside the office. The company adds that care must be exercised in drawing conclusions from these figures; the tests were by no means exhaustive, since such factors as wind direction and the helicopter's load were not taken into account.

Turning to jet aircraft, Dawe Instruments state that they made similar tests during the Farnborough Display last year. The de Havilland D.H.110, piloted by the late John Derry, registered 108 db as it took off, at a distance of about 150ft. A high-speed pass just above the heads of spectators sent the needle up to 125 db—above the "pain" level. The Gloster Javelin was also checked at 108 db during take-off, but while it made a slow pass at about 500ft the meter indicated only 92 db. The noise-level fell to 80 db during a landing approach.

On the general subject of noise-measurement as an industrial technique, Dawe Instruments say that here the primary object, is not usually to determine the "annoyance value" of noise produced, but rather to test the finish and assembly of products. Since sound is merely the audible manifestation of vibration transmitted to the air, a high sound-level presupposes correspondingly strong vibration of some component. It is therefore possible to test the mechanical operation of assemblies by comparing their noise-level with a reference level obtained on an extra-carefully assembled and tested unit. The performance of specific parts is better tested by means of a vibration meter, which gives readings in displacement, velocity and acceleration. Other instruments employed include frequency-analysers and high-speed sound-level recorders.

VICTORY IN THE ATLANTIC

THE story of the war's most critical battle, which started first and lasted longest—that for supremacy in the Atlantic—was carried to its successful conclusion in *Killers and the Killed*, episode 17 of the B.B.C. Television film, *Victory at Sea*. The Allies' difficulties revolved around their inability to provide air cover over the whole of the Atlantic. The radii of action of the Mariners, Venturas, Liberators, Sunderlands and B-17s operating from Bermuda, Newfoundland, Iceland, Britain and the Azores left uncovered a large central area which quickly became a happy hunting ground of the U-boat packs.

Air cover was finally provided and the problem solved by the use of small escort carriers. Several shots were shown of Corsairs, Avengers and Hellcats making practice landings on one of these baby flat-tops.

Impressive sequences of U.S. production of these vessels, and many interesting shots of aircraft such as Hellcats and Corsairs in production, were shown. The episode ended with a reconstruction of the action off the Azores towards the end of the war, when the "jeep" carrier *Guadalcanal* captured U-boat U-505 after a bitter fight. The aircraft taking part were Avengers, with Hellcats and Martlets acting as scouts. One unusual shot showed a Martlet marking the position of the submerged U-boat with machine-gun fire. After surfacing, intense small arms and cannon fire kept her crew below decks until the *Guadalcanal could* put a boarding party on board.

All told, 866 U-boats were sunk—another Allied victory at sea made possible by first securing victory in the air.

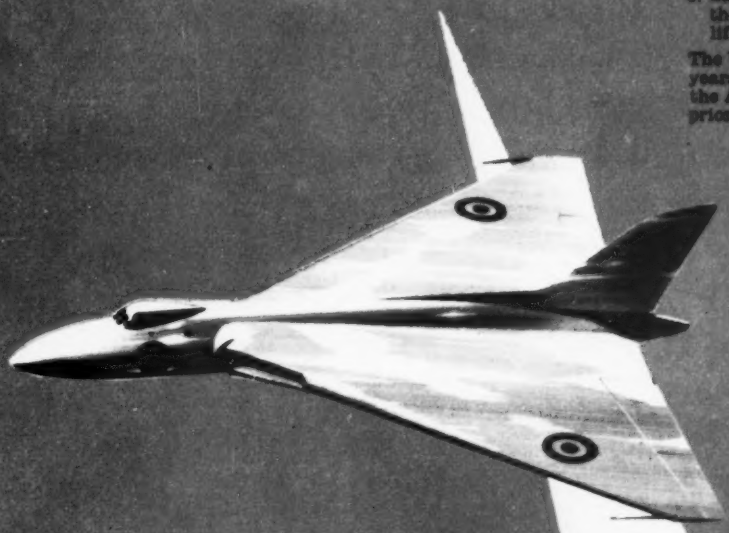
If the Atlantic sea routes were of vital importance to the Allies, then similar routes in the Pacific were of equal importance to Japan—and the Battle of the Pacific just as decisive. This was made clear in *Full Fathom Five*, episode 18. This episode contained several hitherto unseen shots of Japanese war production, but it was the first of the series not to include at least one shot of an aircraft.

What makes the Avro Vulcan the world's most effective bomber?

The answer lies in its Delta configuration which provides:

1. Clean aerodynamics.
2. Thin wings and high sweep back, yet large internal volume for stowage of load and fuel.
3. Low wing-loading for high altitudes.
4. Unrivalled manoeuvrability.
5. Safe and simple landings without the need of complicated high lift devices.

The Vulcan is the result of three years' exhaustive flight testing on the Avro 707 Deltas. Now in super-priority production for the R.A.F.



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(Four de Havilland Gipsy Queen 30 Mark 2 engines driving de Havilland two-blade, variable pitch, non-feathering propellers.)

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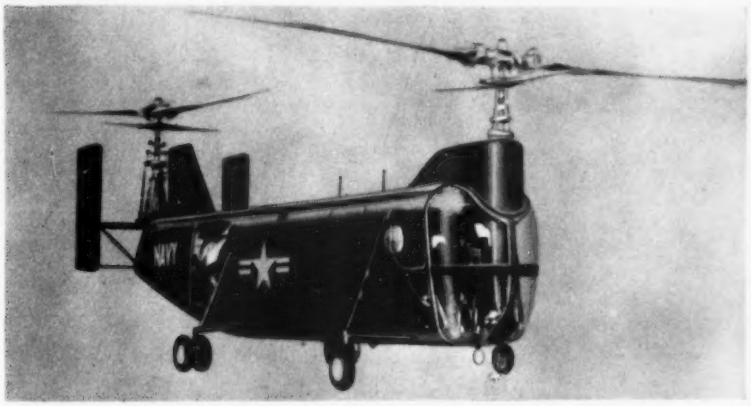


OFFENSIVE WHIRLER: One of the most ungainly-looking flying machines ever to take the air, Bell's XHSL-1 is here seen on its first untethered flight at Fort Worth, Texas. In service, it should prove a nightmare for submariners, for its Double Wasp of 2,500 h.p. is sufficient to lift a heavy load of A.S. weapons. It is referred to in column three.

Great Britain

H.P. Victor. Although boundary-layer suction can, theoretically, provide remarkable gains in aerodynamic efficiency, use of such procedure has in the past been restricted to aircraft of a purely experimental nature. The following passage in *Interavia* is, therefore, of great interest—although we cannot, of course, comment upon its accuracy: "Judging by the H.P.88 experimental aircraft, it is assumed that the bomber is fitted with large-area extension flaps. Moreover, some reports state that boundary-layer suction, using a 'Porosint' type of skin, has been employed to improve maximum lift coefficient and reduce cruising drag."

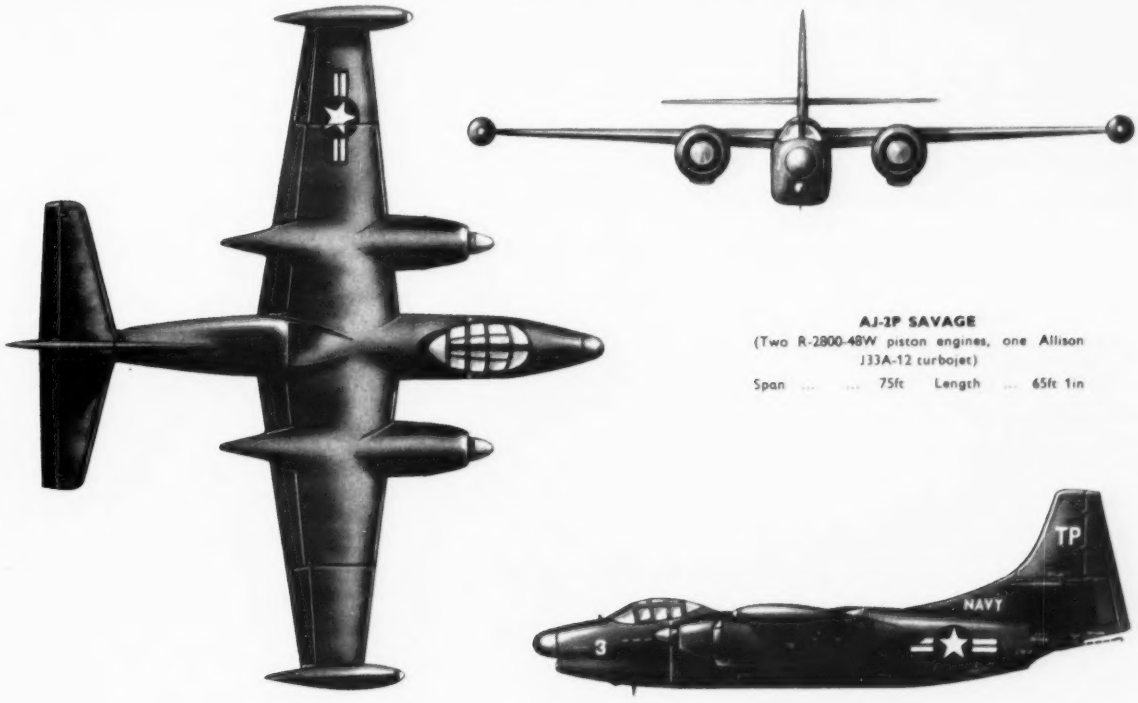
New P.R. Types. Three new types of photographic reconnaissance aircraft will be used by the Royal Air Force; they will replace the present Spitfire 19, Meteor 10 and assorted Mosquitoes and Lancasters. For short ranges a new mark of Swift will become standard, and the first batches of these will go to the 2nd T.A.F. in Europe. A particular advantage of this type will be its supersonic ability, which should enable it to elude all intercepters. For medium ranges, the Canberra will be used; the P.R.3 prototype has been flying many months, but it is understood that the production P.R. Canberra will be of a later mark with greater tankage and more powerful Avons. No doubt this new Canberra—referred to in the debate on the Ais Estimates—will be the type chosen for the New Zealand race in October. Finally, for long ranges the standard reconnaissance machine will be a P.R. Valiant; the speed-with-range performance of this aircraft should be unsurpassed. Although P.R. aircraft were generally under the control of Coastal Command during the late war, Bomber Command will have operational control of the new Canberra—the first squadrons of which should be formed this year.

United States

Grumman types. Present Grumman production consists of the F9F-6 and 6P Cougar fighter and fighter-reconnaissance aircraft, the S2F twin-engined anti-submarine aircraft, and the last batch of AF Guardian anti-submarine types. In addition, flight testing is proceeding with the XF-10F Jaguar, which is a very advanced, but disfavoured, carrier fighter. Powered by a Westinghouse J40 turbojet of between 8,700 and 9,500 lb thrust, the Jaguar has a variable-sweep wing and an "all-flying" tail. But troubles have prevented Navy acceptance for production. The latest news of Grummans is that they are developing an unmanned aircraft, of unstated nature.

North American Savage. The original batch of AJ-1 aircraft, long since completed, are now nearly all used as tankers. The U.S. Navy has converted them to carry Flight Refuelling hose units. The AJ-2 model has a taller fin, tailplane without dihedral and a new crew compartment in which all three crew members sit together. This type is in production at Columbus, Ohio, both as a carrier-based bomber—carrying depth charges, mines, atom bombs or torpedoes—and also as a photographic reconnaissance type with 18 cameras. The latter is the subject of our three-view drawing below.

New U.S. Navy Types. Like Coastal Command and the Royal Navy in this country, the U.S. Navy is developing methods for employing helicopters in an anti-submarine role. Their plans are chiefly based on the Bell XHSL and the Sikorsky XHSS, both of which are big and powerful enough to carry search equipment and a heavy load of offensive stores. It is reported that the most promising method of detecting the submerged submarines is the lowering of a sonobuoy into the sea on the end of a cable, this giving better results than fixed-wing aircraft equipped with large search-radar scanners.



AJ-2P SAVAGE

(Two R-2800-48W piston engines, one Allison J33A-12 turbojet)

Span ... ... 75ft Length ... 65ft 1in

After 12 hours airborne: a beach-stroll on West Island, Cocos (Keeling) Group.

A-roving by Hastings

THE THIRTY-THOUSAND-MILE MISSION OF WJ330

Hastings WJ330.

By H. F. KING, M.B.E.

KOREA is a country of many distinctions, not the least being that it is an uncommonly fine place to leave—if one can do so with an easy conscience. The means of our own recent exit, after some experiences which we hope to recount in future issues, was a Dakota of No. 30 Transport Unit, R.A.A.F., which delivered us with admirable despatch to Iwakuni, Japan.

At this teeming American air base live two Good Samaritans, in the persons of F/L. W. G. Bishop (Officer Commanding Royal Air Force) and F/O. J. A. H. Sorrell, the equipment and air movements officer. For their counsel and aid in procuring further transportation we—writer and photographer—sent up an immediate and urgent bleat, the outcome of which was a promise to intercede on our behalf with W/C. C. S. G. Stanbury, D.S.O., D.F.C., captain of a homeward-bound Hastings of the Royal Air Force Flying College, Manby. We went aboard next morning with movement orders for Kai Tak (Hong Kong).

Thenceforth we had expected to take passage in a courier Valetta, bound for Singapore *via* Clark Field, in the Philippines; but faced with some delay and with the uncertainty of a trunk-route connection at Changi, we needed no second invitation from W/C. Stanbury to follow the fortunes of Hastings WJ330 for the remainder of the trip—by way of the Cocos (Keeling) Islands, Mauritius, Entebbe and Idris (North Africa). The tale which hangs thereby is prefaced with a brief account of the Manby-Iwakuni flight given us by the wing commander when (in the current idiom of the trip) we were able to "latch-on" to a beer at Mauritius.

Though the officially specified object of the mission was a study of the Korean air war, the round trip of 30,000 miles afforded a perfect opportunity for the students aboard to broaden their flying experience. Their names will leave no doubt that this was already extensive—W/C. R. W. Cox, D.S.O., D.F.C., A.F.C.; W/C. K. H. Mackie, O.B.E., D.F.C.; W/C. S. B. Grant, D.F.C.; Lt. Col. W. H. Brown, U.S.A.F.; S/L. J. H. Dempster, A.F.C., R.C.A.F.; and S/L. D. Bower, M.B.E.

W/C. Stanbury was not only captain of the aircraft but leader of the "syndicate," or study-group. His crew were: F/L. A. G. Brown, D.F.C., A.F.C. (assistant to captain), F/L. H. T. M. Williams (navigator), F/L. R. M. Hamilton (signaller), F/Sgt. Woods (flight engineer), and, as ground crew, Chief Technicians Campbell and Tipper and Senior Technician Millard.

The Hastings C. Mk 2, with only 7½ hr flying behind her since being drawn from an M.U., was standard in all respects except that the starboard toilet had been made over as a wardrobe. This was a convenience in more than one sense, for it greatly facilitated quick-changing from blues to K.D.s, to winter clothing and back again—with a few mufti sorties thrown in. And so that off-duty crew members and pupils could "get their heads down" (or, as Col. Brown might express it, "get in some sack time"), a bank of four stretchers was installed aft.

The tankage of 3,172 gallons was reckoned to give a range, to dry tanks, of 3,100 miles, when flying for range rather than endurance; and this was a conservative figure, for we covered the Cocos-Mauritius leg of 2,670 miles with 700 gallons remaining. Throughout the flight a "range" technique was used rather than the constant-power or constant-speed formula; but to avoid complicating the navigator's work unduly by the recommended method of reducing speed by one knot for every 2,000 lb of fuel used, the first six hours of each leg were flown at 165 kt, the second six hours at 160 kt, and the remainder at 155 kt.

Stacked in the cabin and baggage compartments were 1,700 lb of spares, ranging from oil coolers down to instruments. Forty gallons of oil (for our brand was not stocked in the Cocos) was another small item, accounting for 400 lb. Rarely was the take-off weight less than the 80,000 lb limit.

A flight of such extent and intensity must be a test of any aircraft, and WJ330, with her four 1,640 h.p. Bristol Hercules 106s, acquitted herself magnificently. The only snags were a damaged tail-locking unit and three broken magneto springs. Take-off, even in the tropics, was comfortably short, and on leaving Manby only 900 yd of a 1,100-yd runway were needed to unstick.

With its spring-tab controls, improved fore-and-aft stability (conferred by the enlarged and lowered tailplane), extra tankage and other refinements, the Hastings 2 is a far superior aircraft to the Mk 1. We ourselves flew the 13,192 miles from Iwakuni to Manby in rearward-facing troop-seats, with feet up on boxes of spares, and thus installed were happy enough. Especially was this so whenever Chief Technician Campbell, who discharged the office of quartermaster, showed up (as he invariably did at the right moment without prompting from the skipper) bearing coffee or an in-flight meal.

The Hastings had left Manby, her captain told us, on February 12th, and, after 10 hr 25 min airborne, put down at Fayid, in the Canal Zone. Three hours later she was pressing on to Bahrain, where she halted for 11 hr. At Negombo, Ceylon, she was on the ground for only 2 hr; in fact, of 51 hr elapsed between Manby and Singapore, 35 were flying time.

At Changi the captain ordered a two-day halt—not for rest alone but to enable the syndicate to discuss anti-bandit operations with H.Q. Far East Air Force. Then the Hastings headed out over the China Sea for Clark Field, and once again the party was cosseted to the extent of being allowed a night-stop. The 1,756-mile leg to Iwakuni took a mere 7 hr 15 min, and now the students deserted the Hastings for a U.S.A.F. C-46 (Commando), which bore them on to Tokyo for a five-day sojourn with the American F.E.A.F. H.Q. They were greeted by General Weyland and discussed operational techniques with MATS (Military Air Transport Service), FEALOGFOR (Far East Air Logistics Formation), BOMCOM (Far East Bomber Command), the Air Defence Command, and a troop carrier (Combat Cargo) intra-theatre air division. The party was impressed by the scale of the American effort represented by these formations, the variety of aircraft handled (upwards of 30 types) and the manner in which Japanese labour has been recruited to repair aircraft on a production-line basis.

Another Combat Cargo C-46 was the appointed vehicle between Japan and Seoul, whence the syndicate was taken on to H.Q. 5th Air Force. From this focal point the students radiated each day to units equipped with F-86s, RF-80s, F-84s and B-26s; and, of course, they did not fail to call on the illustrious No. 77 Squadron, R.A.A.F., which operates its Meteor 8s with telling effect against ground targets. They were present, too, at one of General Barkus's evening briefings (the General convenes a briefing every morning and evening to allow operations to be reviewed), and there was still time for a visit to the Commonwealth Division. Though the "Div." was out of the line, most of the party went up-front, and W/C.s Stanbury and Cox were lucky enough to witness a fighter/bomber strike by the U.S. Marine Corps.

In addition to the C-46 Commandos, the syndicate made their rounds in L-20 Beavers, a C-119 Packet, and General Weyland's personal C-47 Dakota (or Goony Bird).

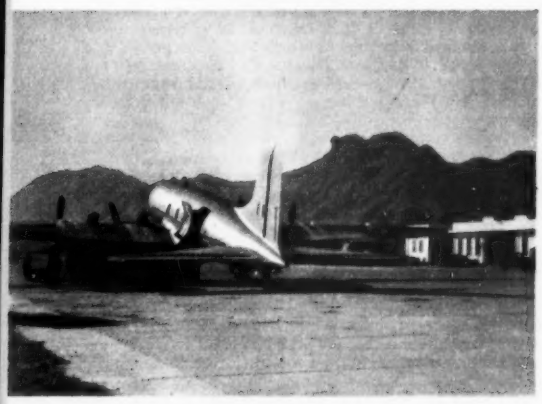
Back at Iwakuni a new tail-locking unit, flown out from England, had been fitted to the Hastings and, as already intimated, it was at Iwakuni that we ourselves "latched-on."

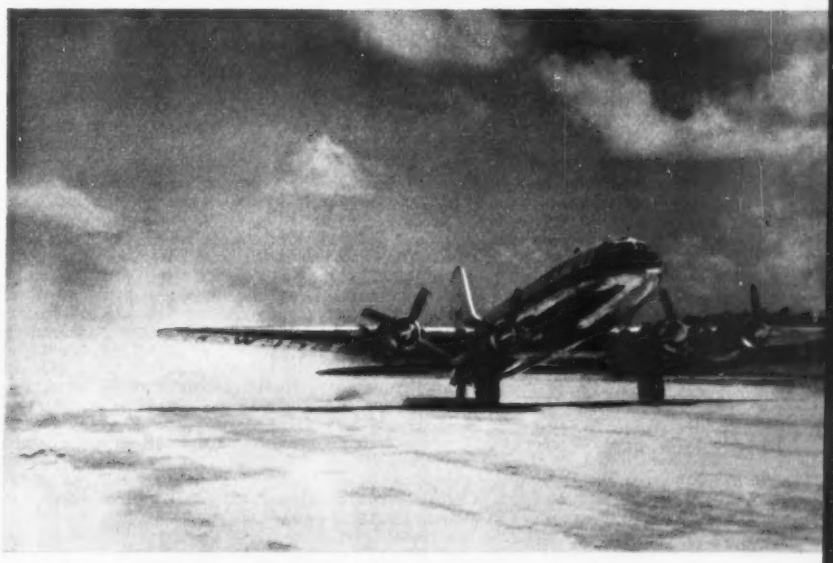
The notoriously mountainous terrain round Kai Tak resulted in an abortive first attempt to land, after 8¼ hr in the air; but on our second circuit we really snuggled into the mountains and a more comfortable approach followed. We sat down without further loss of dignity and taxied in as four Hornets roared out across the sparkling water.

A mag. drop on No. 4 engine detained us at Kai Tak for the greater part of March 4th, enabling us to procure from F/L. Graham our movement orders for the United Kingdom. With the memory of our arrival stubbornly persisting, we noted approvingly the flattening operations on the local hill-tops, undertaken with the object of improving the approaches. The broken rock, one learned, is carted lorrywards by industrious Chinese ladies with baskets.

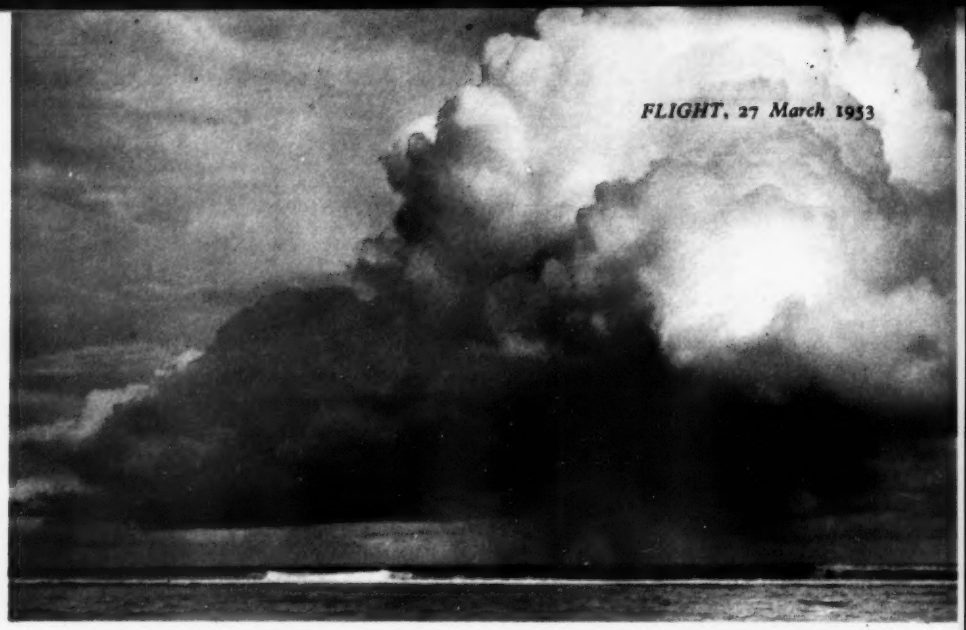
"FLIGHT" PHOTOGRAPHS
By L. W. McLAREN

(Below) Kai Tak (Hong Kong). (Right) V.I.P. Hastings WJ325 distributing the Cocos coral.

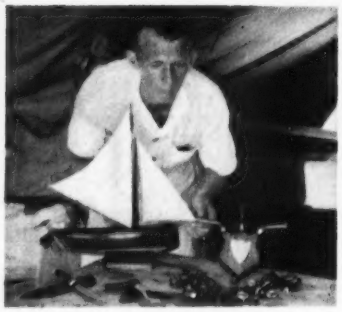




(Left) Lines of No. 2 Airfield Construction Company, R.A.A.F., West Island, Cocos. (Right) Sartorially distinguished from students and crew-members is W/C. Stanbury, captain of the Hastings and leader of the syndicate, with Mr. Neville Sneddon (Qantas) on his left.



(Below) The mask that cheers—at 22,000ft. (Right) Cloud and reef, Mauritius.



Trophies: (Left) A/C. Max Black, R.A.A.F., with shells, knives and ironwood boat. (Centre) The "nav." (F/L. Williams) discovers a relic of his war-time Cocos tour with No. 99 (Liberator) Sqn. (Right) American enterprise, exemplified by Colonel Brown.

The Hastings came quickly unstuck—in the more agreeable sense—on the evening of March 4th, and had built up her safety speed of 125 kt before it became necessary to swing her through 40 deg to avoid the looming hills. Before us lay the 2,660-mile haul to the Cocos Islands, and as the sun went down to starboard in a wondrous flood of green, blue, copper, gold and cerise, the stretchers were fixed up aft and blankets issued for the long night watch. High flying was forecast, so the oxygen masks were unboxed and tubes connected. The masks of the sleepers dangling from the stretchers imparted a realistic "cas. evac." atmosphere.

After 1,300 miles of black nothingness the lights of Singapore began to stream out from under our wings and we persuaded ourselves that we could make out the flying-boat base and airfield at Seletar.

Above Sumatra and over the Indian Ocean the cu and cu-nim were massed against us in defiant array. The Hercules were opened up to climb power and the captain ordered oxygen on. At 18,000ft we were still climbing. For our own part, we could see only the lightning glaring and flashing in the towering black shapes as the Hastings shuddered in her tracks. It was later that we learned from the captain that for an hour we had flown through a tropical front in a mass of cumulus cloud and a near-solid wall of rain and snow. Attempting to rise above it, to allow the navigator to take his astro-sights, we ascended to 22,000ft. There we gave up the unequal struggle, though the wing commander was confident that the willing Hastings would have made 26,000. He told us of the ice so efficiently shed by the T.K.S. de-icers; the St. Elmo's fire which played its spectral light over the windscreen and nose; how, at one time, with 190 kt on the clock and the nose well down, the Hastings was rising steadily; and how we had crossed the equator in a snow-storm. It was generally agreed that this was no night to have been out in. Our own spirits rose inversely with the rate of descent towards the lights which marked the coral runway of the Cocos Islands.

We came in over the reef, showing like a livid scar in the blackness and, as the wheels touched, we blessed Sir Frederick Handley Page, designer Stafford, assorted Bristolians, and—for having risen from their beds to welcome us—the friendly Qantas folk. In various states of undress they stood waiting under the stars.

Having hoped for the distinction of being aboard the first Hastings into the Islands, we were quite taken aback when we discerned a sister ship, much shinier than our own, with great polished spinners and white-topped fuselage. Against the background of palm trees she stood proudly on the coral which glinted under the floodlight like snow. We identified her as WJ325—a Mk 4 V.I.P. machine for the use of the C.-in-C. Far East—the same that we had admired at Negombo on our outward journey.

We dumped our bags in the neat little twin-bedded rooms, shaved and breakfasted; by which time the sun was up. The sight and sound of breakers through the palms, and the exhilaration of a heat-defying breeze, dispelled fatigue; in 60 seconds flat we were into swimming trunks and on course for the beach.

We were deeply occupied in a cowrie-search when an indubitably Australian hullo brought us face to face with a sun-burned gentleman in elderly khaki shorts. He introduced himself as the cook from the R.A.A.F. tent lines among the palms, and though we never learned his name, we now acknowledge his courtesy in explaining the wonders of the shore and the reef, and in showing us how he and his fellow Diggers ate, slept and decked their tents with trophies.

From these tough and kindly men of No. 2 Airfield Construction Company, R.A.A.F., we heard how the task of building an airstrip on West Island, to enable Qantas to start a service to South Africa on September 1st, 1952, had been tackled. The main body of the squadron, numbering about 400, arrived on December 19th, 1951. An advance party had already erected a camp and prepared cooking, sanitation and water-supply facilities. The supply ship, with 7,500 tons of equipment, arrived on January 23rd, and work on the strip was got under way on February 9th. It was necessary to remove 7,500ft of P.S.P. steel matting before grading the surface—a heart-breaking and back-breaking task which inspired the squadron engineer officer to mount a sort of super tin-opener on a tractor. It prised up planking at such a rate that none remained by the end of April. For the foundations of the strip, and to level the shoulders, it was necessary to shift 102,000 tons of earth, and 75,000 tons of coral were needed for the runways and taxiway.

Qantas, too, are doing a fine job on West Island. One of their more recent developments has been the installation of D.M.E. for the use of the Constellations maintaining the Johannesburg service through the Cocos and Mauritius. Though none of the Qantas

ejection seats

The Martin-Baker Mk. 2 *fully automatic* Ejection Seat fitted to the Gloster Javelin and now in production, is designed to reduce escape procedure to the minimum.

Once ejection is made, the complete sequence of releases from the seat is automatic and no further action by the occupant is necessary.

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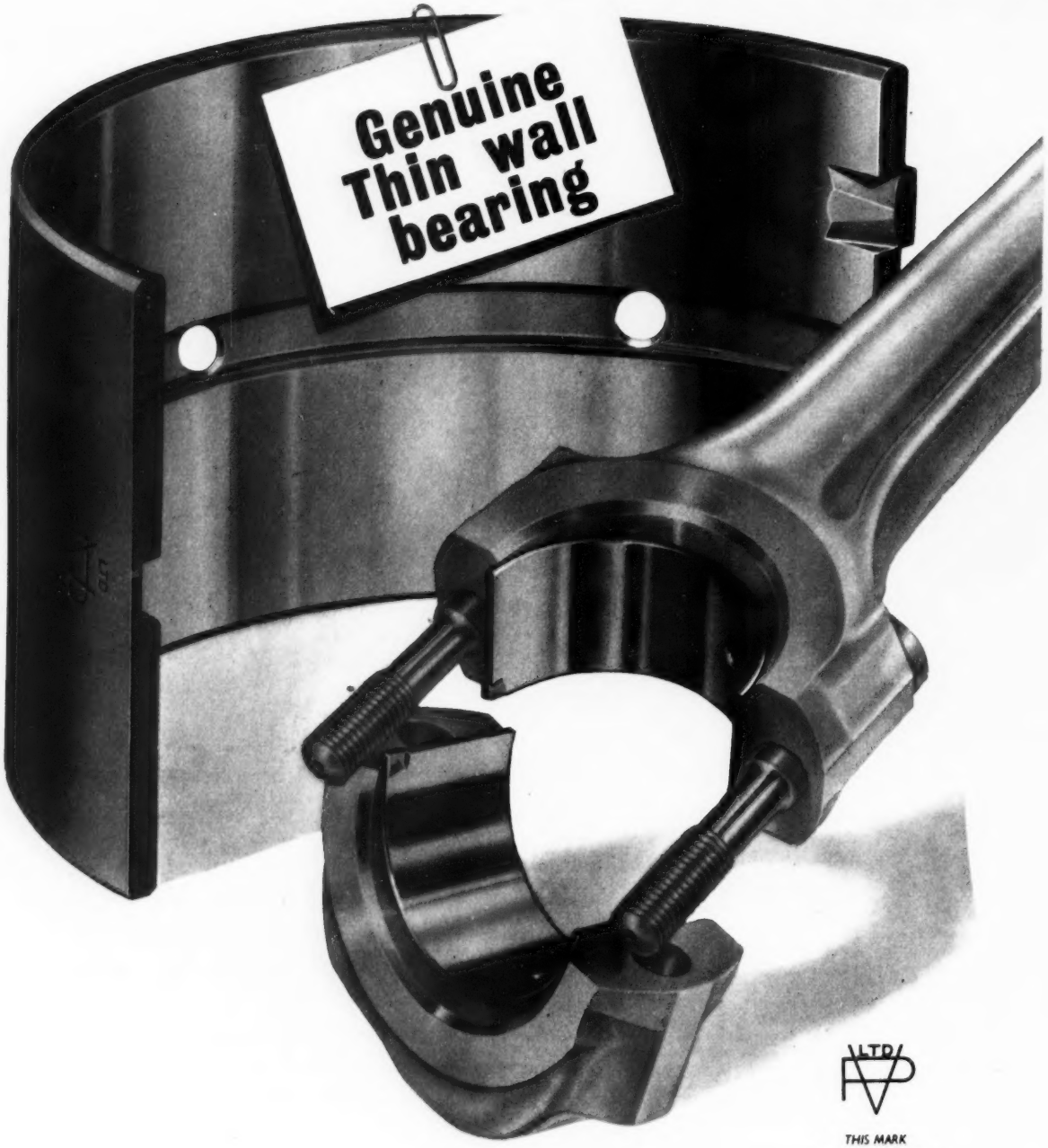

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A-ROVING BY HASTINGS . . .

navigators have ever experienced any difficulty in locating the Cocos, for an aircraft fitted with D.M.E. of 200-mile range the beacon will virtually expand this little group of islands to an area 400 miles in diameter.

A senior captain of Qantas who happened to be visiting the island when we called, told W/C. Stanbury that he was amazed by the range, height and speed performance of our Hastings.

Mr. Neville Sneddon, the Qantas liaison officer, was our guide round West Island, as a result of which the Hastings was heavier by a considerable poundage of coconuts, coral and shells when she took off after dark that night (March 5th). Most of the nuts we had left in their husks and stowed in the ventral compartment, but a few we had husked for our refreshment in the air. In this we had erred, for when, after traversing an unforecast front 4 hr out W/C. Stanbury reached into his locker for a succulent nut, he suddenly found himself milk-drenched. Stalking aft to examine the lovely bunch in the rack above us, he discovered that each had burst under internal pressure as we had climbed to rarefied air—not, as might be supposed, through its "eyes," but cleanly around the shell.

We were further diverted by the spectacle of W/C. Cox and Col. Brown sleeping the sleep of the very weary with the bumps flipping them up from their stretchers like Shrove Tuesday pancakes.

Soon after first light on March 6th we put down on Plaisance airfield, on the island of Mauritius. The Cocos were 2,670 miles behind us and we had been 11 hr 47 min in the air—having exceeded the Qantas Connies' time by only 30 min. S/L. Bower's astronav. had been faultless, which was a matter for quiet satisfaction, for had we missed Mauritius our nearest land would have been Reunion, 125 miles on, or failing that, Madagascar, 300 miles away.

We relaxed in Mauritius until March 8th and our stay was made the more pleasant by Mr. Rouillard, Chief of the Department of Civil Aviation, and by officers of the Royal Pioneer Corps Depot. Again all hands investigated the marine—and other—life, and roamed unconfined around the shores of this green island.

The night we found rather more crowded. At one time our room-mates were one *Flight* photographer; three frogs (two of them highly aerobatic, the third grounded under a bed); a dart of lizards; and a creep of centipedes. The giant snails were less sociable : not one of them would enter to join the merry company. They stayed outside, where one could hardly fail to trip over them in the morning.

Early, if not bright, on Sunday, March 8th, we were out of Plaisance again, waiting for the crew to return from briefing and admiring a white, red and silver Qantas Constellation under the shell-pink sky. C/T. Campbell really made a fuss of us in the air that day. For lunch there was soup and corned-beef salad, and pineapple served on dragon-patterned plates selected from his "loot."

We overflew Madagascar and picked up the African coast after about 7 hr. Then the Hastings rose to 16,500ft. With oxygen masks on, we peered up at the cloud-tops still soaring above us and at the brown and green mountains below. The coat hangers were swinging in the turbulence when the word came aft to look to starboard. We caught a fleeting glimpse of Kilimanjaro, topped by a Z-shaped streamer of cloud, before the 19,320-ft peak was covered in its eiderdown of cumulus.

Across Lake Victoria we let down to Entebbe on the far shore, and as the Hastings arrived the wind slewed her clean across the runway. She could have used a Hermes nosewheel.

When we returned to Entebbe on the afternoon of March 9th, having spent the night in a real hotel, with hot water and lie-down baths and two bars (but with frogs picketing the path to one of them) we met W/C. Stanbury as he came from briefing. The distance on to Idris, he announced with feeling, was 2,560 miles, for 2,558 of which there was sweet nothing at all—or words to that effect. So for 11 hr 57 min the Hastings traversed the most desolate wastes of the African continent, taking another unforecast front in her stride.

A few hours out, F/L. Hamilton heard a Comet wireless operator signing out from Entebbe, with a laconic "Climbing to 38,000ft, speed 385 kt." That, we reflected, was the way to cross Africa. Twelve hours is too much flying at a stretch, even in a Hastings. We were too tired, in fact, to be much interested in a night landing at Idris, where the Hastings took on fuel for the final leg—a small matter of 1,540 miles.

Over the French *massif* we had the second pilot's seat, alongside W/C. Grant, and we watched the trim, and consequently the speed, fluctuate as the students scurried to and fro to shave, change into blues and assemble their baggage. The navigator called up to remark that we were three minutes behind schedule and that, as the I.A.S. was only 165, would the pilot please step it up to 170. W/C. Grant called for another 25 revs, and the pitch levers on the cockpit quadrant moved a fraction of an inch as the flight engineer changed their setting from his position. The A.S.I. needle stayed put. Another 25. No move. Same again. The needle shifted fractionally—backwards. Twenty-five more. And we were back to our original 165 kt. Evidently a Hastings is not to be goaded by pinpricks, especially when she is a little out of trim. But more drastic treatment as we neared Manby (and perhaps the settling-down of the student body) sent the needle up to 200 kt at 12,000ft—equivalent to a ground speed of about 290 m.p.h.

Manby homecoming; with A. Cdre. Ubee, Commandant of the Royal Air Force Flying College, interrogating W/C. Stanbury.

And so we came home; and to mark the occasion W/C. Mackie made the landing—his first in a Hastings. It was gentle enough to allow the party to descend unshaken into the warming presence of families and brother officers, with the Commandant—A. Cdre. Ubee, C.B., A.F.C.—at their head.

Having marshalled their sandalwood boxes, African carvings, bananas, coffee services and coral, the students resembled (in W/C. Cox's estimation) a bunch of commissioned barrow-boys. One by one they braced themselves, blanched a little under their tan, and submitted themselves and their treasures to Her Majesty's Customs.

They came out smiling.

FORTHCOMING EVENTS

Mar. 27. R.Ae.S.: Full-day discussion on "Fatigue."
Mar.27-31. ASLIB Aeronautical Information Group: 1953 Conference, Cranfield.
Mar. 31. R.Ae.S. Section Lecture: "Experimental Work on Boundary-layer Flow," by W. E. Gray.
Mar. 31. R.Ae.C.: Film Show.
Mar. 31. Aircraft Recognition Society (Plymouth): "Guided Missiles", by Gerald D. Scott.
Apr. 11. British Interplanetary Society (Manchester): Conversazione and Film Show.
Apr. 15. Institute of Transport: Brancker Memorial Lecture: "Influence of Military Aviation on Civil Air Transport," by Sir Frederick Handley Page, C.B.E.
Apr. 15. Aircraft Recognition Society: Annual General Meeting.
Apr. 18. British Interplanetary Society: Film Show.
Apr. 22. R.Ae.S. Graduates' and Students' Section: "Accident Investigation," by H. Caplan, D.C.Ae., Grad.R.Ae.S.
Apr. 23. R.Ae.S.: "Civil Jet Operations," by Capt. A. J. Majendie, M.A., A.F.R.Ae.S. (at Glasgow).
Apr. 25-26. R.Ae.C.: Private Air Rally, Co. Wicklow.
Apr. 28. Air League of the British Empire: Aviation Jubilee Ball, London.
May 9-10. Brest and Côte des Légendes Rally.
May 14-17. American Helicopter Society: Forum, Washington.
May 14-22. F.A.I.: 46th Annual Conference.
May 16. Wolverhampton Aero Club: Goodyear Trophy Race and Display.
May 21. R.Ae.S.: All-day Meeting on Aeronautical Acoustics (jointly with the Acoustics Group of the Physical Society).
May 23. Derby Aero Club: Display.
May 25. S.S.A.F.A.: Display, Yeadon.
May 29. R.Aux.A.F.: Officers' Coronation Ball, London.
May 30. Auster Flying Club: Ragosine-Auster Homing Trophy Competition.
May 30. Swansea and District Flying Club: Display.

THE NEED for TECHNOLOGISTS

Past City and Guilds Students on Scientific and Engineering Education

IN *Flight* over the past twelve months have appeared many opinions and statements concerning the problems of technicians and technologists in the aircraft industry. That the problems of training such men are of concern also in other branches of industry is not unknown, and many relevant views have been expressed concerning the overall picture. A recent and important contribution to thought on this subject was the symposium organized by the Old Centralians (the old students' association of the City and Guilds Engineering College of the Imperial College of Science, London), on Monday, March 16th.

Mr. A. G. Ellis, F.C.G.I., M.I.E.E., president of the Old Centralians, first explained briefly the purpose of the symposium. "How can future needs of the country for engineering and scientific technologists best be met?" was the theme question, intended to complement and follow-up the previous debate on the place of technology in a university, held in October, 1951, which had provoked so much interest. Leading the discussion were to be three eminent Old Centralians, experts respectively in electrical, aeronautical and civil engineering.

Sir Arthur Fleming, C.B.E., F.C.G.I., director of Metropolitan-Vickers, spoke first. Outlining the personnel structure of the electrical industry, he pointed out the need for the continuous advance in technical level of personnel to keep pace with expanding scientific knowledge, and the importance of the creative mind. Important, too, were the personnel who could apply new knowledge and particularly those who, with a background of sound technical knowledge, also possessed the ability to direct and manage the complex conditions of modern production.

To fill these requirements, Sir Arthur continued, the first consideration was to discern inherent capacity and aptitude, and then to provide the appropriate education and training to enable the trainee to take his place in the personnel structure, providing at the same time every facility for upward mobility. The number of young men of the brilliance required for the topmost level was lamentably small, but from whatever source they were selected—public schools, universities or industry—further means were required for this progressive education up to the highest possible technological level. For personnel other than those of the topmost level, it was probable that existing facilities for training could be adapted and developed to meet the engineering industry's expanding needs.

Suggestions which had been made as to the present and future requirements included the provision of more universities, the upgrading of certain technical schools and the setting-up of technical universities similar to certain institutions on the Continent and in the U.S.A. Whatever development lay ahead, in the speaker's opinion, there should basically be more contact between industry and the universities. In the expansion of Imperial College on the lines of a technological university, he was sure the syllabus would not be too specialized, and it would be possible to bear in mind the experience of this College in the expansion or development of other institutions later.

The second speaker, expressing the viewpoint of an aircraft manufacturer, was Sir Frederick Handley Page, C.B.E., F.C.G.I., chairman of the City and Guilds Council. He first stated that the discussion on that evening's question must be linked to the more fundamental problem of the type of recruit industry was seeking. In the upper levels, with which their discussion was concerned, pure scientists for research and experimental work, applied scientists and technologists were all required, technologists being persons who had studied the application of the results of scientific knowledge to industry and the arts. From these sources, industry had also to find people concerned with methods of production and those suitable for management.

Industry, Sir Frederick continued, looked for certain qualities in its senior staff, including a first degree standard in an appropriate subject, integrity of character and personality, and the ability to remain contemporary in thought. This last meant the ability at the age of 40 to think in terms of science and technology of the day (and of tomorrow) and not in terms of what had been learned at the university twenty years earlier. Other essentials were the ability to mix with contemporaries and a potential capacity for leadership.

The products of whatever our training systems might be depended on the quality, the content and the environment of the teaching, apart from the innate qualities of the student. In the quality of teaching, the universities had traditionally excelled. The training and character and personality which the best of our teachers in schools and universities had provided had been due to the contact of the student with great minds and the abiding influence of the integrity of the university don. Concerning the content of the teaching, a close examination of the parts played by the science and technology faculties of institutions was necessary. The speaker went on to develop the theme that more specifically technological study and experience was needed than was at present provided within our educational institutions.

On the environment question, the traditional sequence of training, i.e., school, three or four year full-time education in a university or technical college, and then entry to industry, seemed questionable. Contact with industry should be made much sooner.

A variety of training systems was needed to meet the different needs of different industries, and different levels of students. The right institution for work up to the first-degree standard might not be the right one for post-graduate work, and the right one for post-graduate study might not be the best for post-graduate research.

All this presupposed that people of the right quality did, in fact, enter industry or begin technological studies after leaving school. Whatever their concern for the training of their engineering and scientific technologists, the future needs of industry would never be met without successful recruitment. "We have got to make science and engineering fashionable." The universities and other institutions took both credit and blame for much that was not their responsibility, but was that of the schools, and much had been determined by the time a boy left school. If industry's future needs were to be met, industry and the technological education authorities must convey to parents and headmasters the country's needs and the opportunities offered.

A vigorous speech was then made by Mr. H. J. B. Harding, F.C.G.I., director of John Mowlem and Co., and a council member of the Institute of Civil Engineering, who described himself on that occasion as "a pawn between two knights," and a representative of the industry without whose efforts the previous speaker could not take-off.

The required amount of expansion of training facilities, Mr. Harding went on, might well have been over-estimated after the war. The form of such expansion should depend upon the type of technology, and the character and family background of candidates should be taken into account, as well as school results. Concerning possible forms of expansion, the foundation of new universities might be criticised on the grounds of lack of tradition. Such bodies were best formed by gradual growth and, if they prevented men gravitating to London and other big cities, there was something to be said in their favour. The expansion of existing facilities, it seemed, should be pursued as the most preferable scheme

The chief objection to the suggested establishment of a technological university was the collection of too much full-scale apparatus which would become rapidly obsolete. Another great objection was the lack of necessity, when existing facilities could be enlarged. Consideration should be given to the problem of increased size in universities and colleges which, if carried too far, turned the head of the college into a mere administrator.

Further points discussed were the recruiting, status and payment of teaching staff and their ability to refresh themselves by contact with industry, British methods of teaching and examination, and the dangers of having too narrow a line of training. A wider syllabus was desirable, concluded the speaker, after referring to over-specializing mathematicians, for always present was the danger of turning out a "standard British engineer."

After a short break for the buffet supper, the discussion continued. Among the distinguished speakers were Professor J. F. Baker, O.B.E., M.A., Sc.D., D.Sc. (head of the Cambridge University Engineering Dept.); Sir Wallace Akers, C.B.E., F.R.I.C., F.R.S.A., F.C.S., Hon. D.Sc. (director of research, I.C.I.); Professor A. J. S. Pippard, M.B.E., D.Sc. (dean of the City and Guilds College); Mr. Harold Bishop, C.B.E., F.C.C.I., B.Sc. (director of technical services, B.B.C.) and Professor Willis Jackson, D.Sc., D.Phil., M.I.E.E., F.I.P. (until recently dean of the City and Guilds College).

Many variations on the evening's main themes were heard, and also opposition to the suggestions that the Imperial College expansion represented the introduction of a technological university, that technicians and technologists were the same, and that undergraduates and post-graduates should be kept apart. The merits and demerits of colleges such as the Massachusetts Institute of Technology were exhaustively described, and also the suggested ideal university age and syllabus. Many differing views were expressed on the exact needs of industry, and of the way in which Imperial College in particular should meet these needs.

(*Concluded on page* 408.)

AMERICAN EVALUATION

—*of Marconi V.O.R. Installation: Flight Test by C.A.A.*

THE relative merits and demerits of the V.H.F. Omni-Directional Range navigational system are still a matter of much discussion in this country. Nevertheless, few who are interested in the subject of navigational aids for aircraft can have failed to be impressed by the details and model of the Marconi V.O.R. installation on view at Farnborough last year. A comprehensive series of flight tests on this equipment has recently been carried out by the International Field Office of the American Civil Aeronautics Administration, and the official report of these tests, which is given below, confirms that the equipment is of a high standard. This unit of the C.A.A. is based in London, and since 1949 has made a number of similar tests on other such installations in Europe, using a specially equipped Dakota. The unit's report follows.

Results of Flight Check: Marconi Prototype V.O.R.—Flight checks were conducted on the Marconi Prototype V.O.R. over the period of December 12th-31st, 1952.

This V.O.R. is the first of its type to be manufactured by Marconi's Wireless Telegraph Co., Ltd., Chelmsford, England. It was installed at an Air Force Base in the West of England, and was operating experimentally on a frequency of 115.0 m/cs. Since it was a prototype station, only single equipment was installed. Power was provided by a portable A.C. generator. The purpose of the flight check was to determine the technical performance of the equipment. No attempt was made to evaluate the site and, as much as possible, any effects on equipment performance due to site irregularities were removed from the final data. This was done because the site was temporary, and no use was planned for it as a permanent V.O.R. location now or at any future date.

The flight check was made using the C.A.A. aircraft N-17, which is operated by the C.A.A. International Field Office in London, England. Airborne V.O.R. equipment used for the calibration consisted of two 51R-2 Collins receivers calibrated at the London I.F.O. In addition to the receivers, other calibration equipments used were: Collins dual channel D.C. amplifier, crown pen amplifier, two Esterline Angus recorders, and meters of various types to measure reference voltage, variable voltage, A.V.C. current and D.C. supply voltage. These voltages are tapped off at various points in the receiver and displayed on the meters in order to determine characteristics of the ground equipment during the check flights.

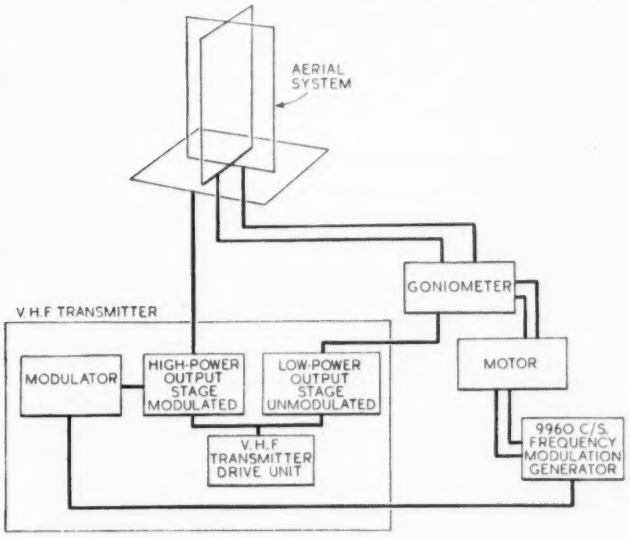
On December 12th, 1952, three theodolite checks were made to determine the total error generated by the ground station. The procedure used in this type check is as follows: the aircraft flies a counter-clockwise orbit around the ground station at a fixed distance and altitude—in this case at five miles and 1,000ft. Bearings are given to the aircraft every ten degrees by an operator at the station, who is tracking the aircraft with a theodolite. The visual bearings are compared with the bearings transmitted by the ground V.O.R. equipment. Both bearings, those from the V.O.R. and those from the theodolite, are recorded using an Esterline Angus recorder, and the actual comparison is done after the flight is completed. Error introduced by the V.O.R. receiver is included in the tabulation of the final result.

On December 18th, 1952, radial flights were made to determine the following characteristics: (1) flyability of the radials; (2) course sensitivity; (3) vertical polarization effects; (4) maximum usable distance; and (5) ground station error.

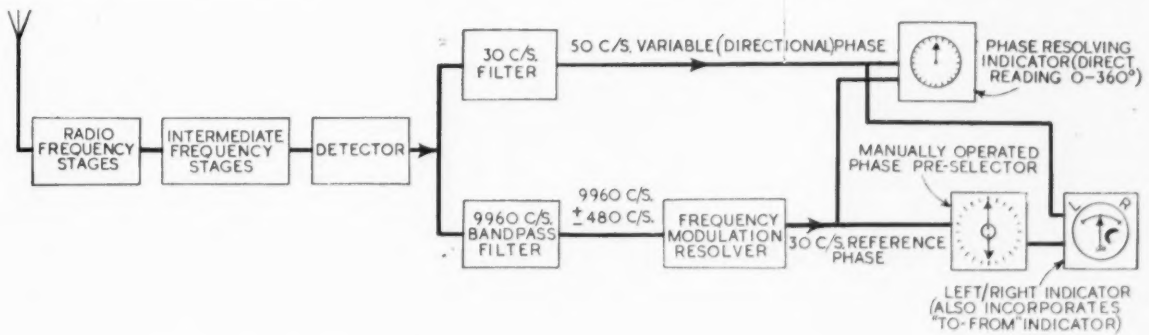
Radial flights are made by flying along any given radial, usually out to the maximum usable distance of the station, which is about 45 miles at 1,000ft above the station. During these flights any deviations, such as scalloping and bending are noted and recorded by the pilot under the classification (1) flyability of the radials. Course sensitivity, normally 20 deg, is checked and recorded for each radial flown. In accomplishing this, the pilot merely measures the course-width—five dots to five dots—on his course deviation instrument by shifting his omnibearing selector.

The normal test for vertical polarization component in the radiated signal is the 30-deg wing-rock. Therefore, on each radial flown, the plane was rolled first 30 deg in one direction, then 30 deg in the other, while keeping the heading steady. Any movement of the course deviation indicator from its "on course" (vertical) position is taken as the amount of vertical component present. In most V.O.R. installations, this is about one dot, which is the equivalent of two degrees.

At least one radial is tested for maximum usable distance. This is defined as the point at which the course sensitivity (width) has



Block diagram of the V.O.R. transmitter system (single installation). The upper aerial has a rotating figure-of-eight polar diagram, while that of the lower horizontal aerial is omni-directional.



Typical aircraft V.O.R. receiver and indicators, shown in block form. A prescribed track can be flown, or position fixes may be obtained, and R/T. facilities can also be contained in the transmission.

AMERICAN EVALUATION . . .

increased to twice its normal value. Under present standards this corresponds to a width of 40 deg. Also, the course is flown until the flag on the receiver flag alarm circuits shows on the pilot's course deviation indicator. This corresponds to a signal field strength of about two microvolts. Usually, the double course sensitivity indication and the flag alarm occur at about the same time.

In testing the ground station error during radial flights, the pilot notes fixed check-points, which are positively identifiable pin-point fixes, while flying the radial. This fix, compared with the actual plotted position of the radial on a map, will give an indication of the course error. This method, however, is less accurate than the theodolite method, due to vertical parallax, chart errors, and drafting error. It is found that usually the station errors measured with the theodolite method are greater than those using the radial flight system.

The results from all the above checks are continuously recorded during the flights on an Esterline Angus recorder.

On December 31st, 1952, flights were made to determine the cone-width above the station and the error effects due to aircraft attitude. Cone-width checks are made by flying over the station from various azimuths and recording the fluctuations of the course deviation indicator in the area directly over the station during which there is no usable course. This check is of limited accuracy due to extreme difficulties of maintaining a course directly over the station and intercepting the reciprocal radial immediately after cone passage.

In determining aircraft attitude effect, a test called a "push-pull" run is made. This consists of flying the aircraft in cloverleaf patterns back and forth across any given radial. Each time the aircraft crosses the radial, an operator at the V.O.R. station who is tracking the aircraft with a theodolite gives the pilot a visual bearing. These bearings from the theodolite compared with the bearings indicated by the V.O.R. for different angles of approach to the radial indicate the error due to aircraft attitude. Normally these errors total about one dot which corresponds to two degrees.

Results: December 12th, 1952—Theodolite Checks.—The ground station error and receiver error as measured in the two five-mile, 1,000ft circles, have been plotted on the same graph. The total error spread is less than five degrees, which is well within accepted tolerance. The total permissible error for operational V.O.R. installation is seven degrees. It is believed that with further refinements in tuning, alignment, and siting, and with the construction of a permanent station, the total error spread may be materially reduced. On this check, several flights over the station were made before and after the theodolite runs. Data are included on the calculated cone angle from these tests.

December 18th, 1952.—A complete tabulation of the radials flown, course errors observed, voltages measured, course sensitivity measurements, ground check points used, and distances flown on each radial has shown the following summarized results :—

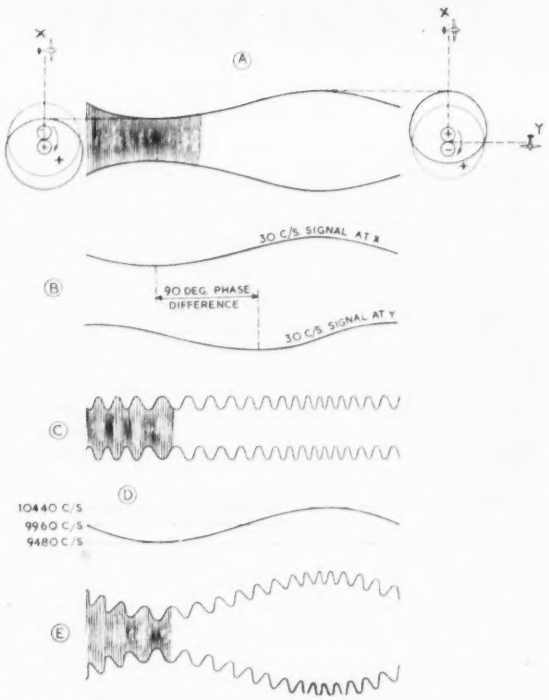
(1) Flyability of radials.—Very good. No noticeable bends or course scalloping which could be traced to the transmitting equipment.

(2) Course sensitivity.—Very good. Very little deviation from the normal 20 deg sensitivity standard. All measurements were within the tolerance of 18 to 22 deg.

(3) Vertical polarization effects.—The results of wing-rock checks on all radials showed a maximum effect of ½ dot which is equivalent to one degree. This is very good.

(4) Maximum usable distance.—One radial, 270 deg. was flown for 70 miles at an altitude of 2,000 (MSL) ft before receiving a flag indication. This exceeds optical line of sight, plus 15 per cent, which is normal for all V.O.R. systems.

(5) Ground-station error.—The ground-station error as estimated by the pilot while flying the radials has been tabulated for each radial flown.



Principles of V.O.R. operation. Details shown in the drawing are:—(A) The rotating field pattern combined with the omni-directional signal modulates the V.H.F. carrier wave as shown (for aircraft bearing 0 deg); (B) the 30 c/s. output from the 30 c/s. filter in the aircraft receiver. The phase changes as the aircraft's bearing from the ground station alters; (C) 9,960 c/s. plus or minus 480 c/s. modulation superimposed on V.H.F. carrier feeding into omni-directional transmitter aerial; (D) cyclic variation of 9,960 c/s. modulation between limits shown. Output of F.M. resolver in aircraft receiver converts this cyclic variation into the 30 c/s. reference phase; (E) graphical representation of the complete V.O.R. signal, including 30 c/s. A.M. variable phase signal, 9,960 plus or minus 480 c/s. F.M. reference phase signal, and V.H.F. carrier (aircraft bearing again 0 deg).

December 31st, 1952.—A complete tabulation of the calculated cone-width angles shows that the average angle, measured from a vertical above the station to one side of the cone, is approximately 40 deg. Total cone angle is therefore about 80 deg. This is about the same width observed with the five-loop Alford system used by the C.A.A.

Measurements of the "push-pull" runs [tabulated in the report] showed that the total attitude effect measured on the 090-degree radial was 2-2/3 degrees, which is about the same as that received from other systems.

Conclusions.—It was the unanimous conclusion of the C.A.A. personnel participating in these flight checks that all characteristics of the particular V.O.R. tested were very satisfactory. It is realized that the flight time (approximately 15 hours) devoted to this project is insufficient to evaluate fully all the characteristics; however, none of the checks made showed any irregularities, and the results were well within presently accepted tolerances.

THE NEED FOR TECHNOLOGISTS (Continued from page 406)

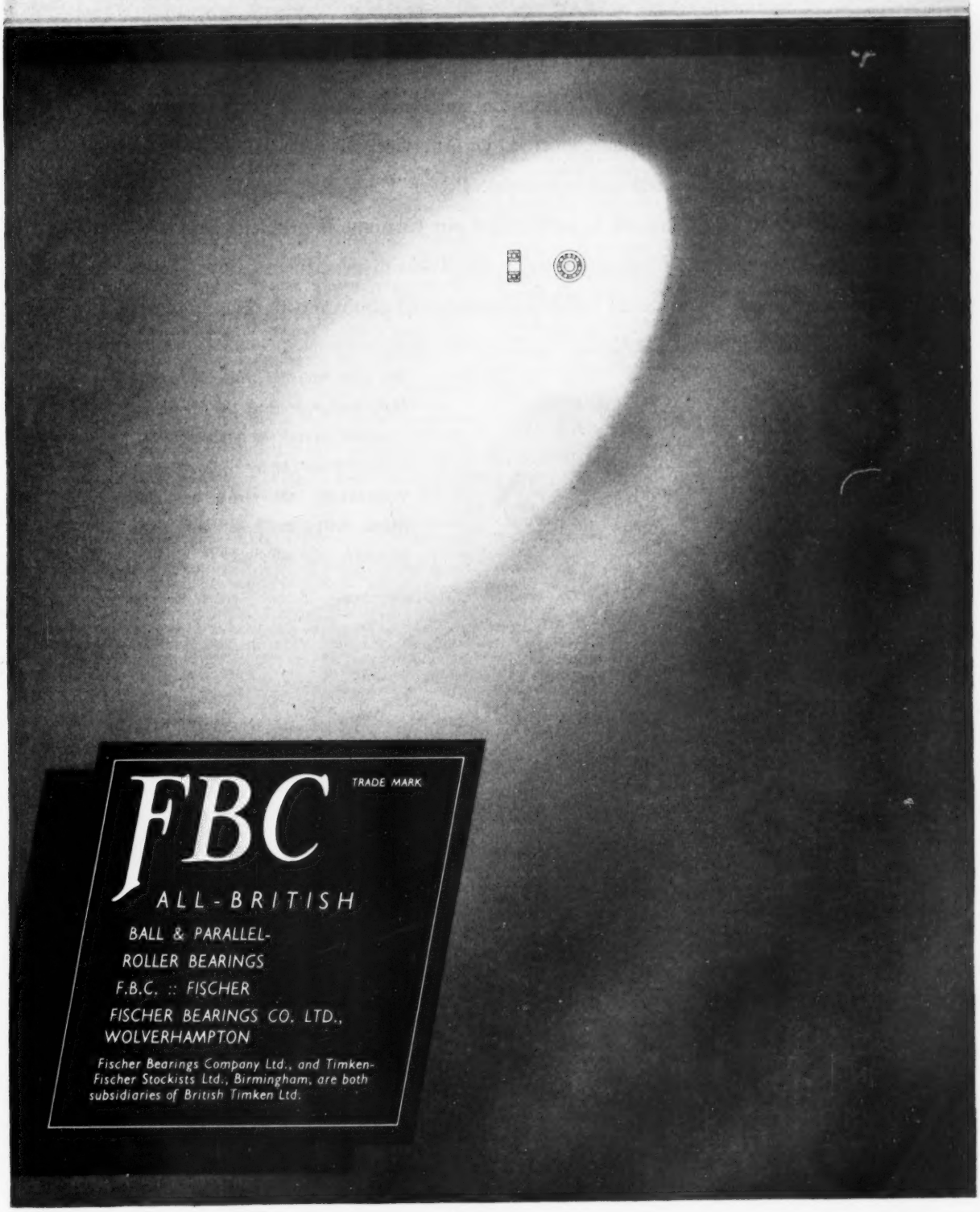
Several speakers had hoped for further news of the recently announced expansion plans for Imperial College, and the general interest in this topic was obvious as Air Chief Marshal Sir Roderic M. Hill, K.C.B., M.C., A.F.C., M.A., F.R.Ae.S., Rector of the College, rose to speak. Not a lot more could be said concerning the project at this early stage, he began, but the January announcement had come as the climax to a long series of discussions. He was pleased that the professional institutions were in favour of the scheme. It was going to be difficult to obtain undergraduates of the right calibre, and expensive to maintain post-graduates who had industrial experience. It was clear, however, that Imperial College would be expanded firmly on the basis of its three constituent colleges.

The speaker deduced that the expansion—in quality as well as quantity—would take place mainly on the post-graduate side; probably included in the new ventures and methods would be inter-departmental laboratories, where pure and applied scientists would work together on joint projects at an advanced level. More important than the outward expansion of the buildings was the need to build *upwards*, and to erect a nucleus of large, central buildings to house the larger elements and the inter-departmental laboratories. The difficulties should not be under-estimated, Sir Roderic concluded, and a mixture of adventure and caution was needed.

Other speakers during the evening included Mr. M. W. Humphrey Davies, M.Sc., M.I.E.E., lecturer in the City and Guilds College, and Mr. A. M. Holbein, C.B.E., F.C.G.I., B.Sc., D.I.C., M.I.C.E., chairman of the technology department of the City and Guilds Institute, and hon. secretary of the Old Centralians.

Miniature bearings

TO ALL SIZES AND SPECIFICATIONS



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But the moment this Economist bloke had crept away the Managing Director slipped the Monthly Sales Chart from under his blotter. **"Another all-time record, Miss Buggins"** *he said complacently, the old twicer!*

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NAVAL AVIATION OUTLOOK

First Lord, in Estimates Debate, Reviews Progress and Prospects

AS we briefly recorded last week, Naval Aviation came in for a certain amount of attention from the First Lord of the Admiralty, Mr. J. P. L. Thomas, when he introduced the Navy Estimates, 1953-54, in the House of Commons on March 16th.

A brief reference to Soviet naval aviation was made by Mr. Thomas during the opening part of his speech, which consisted of a significant review of Russia's steadily growing sea-power. He said that she had a powerful naval air force, including an increasing proportion of jet machines which could be used either for bombing or torpedo attacks or for minelaying. Although all aircraft were admittedly shore-based, the Soviet naval air force was an integral part of the Russian Navy; so the combined power would allow Russia, if war should come, not only to meet her defensive commitments, but also to lend very powerful support to any land and amphibious operations, and also to wage an offensive war against our sea communications.

Turning to our own potential, Mr. Thomas mentioned the five carriers now building, and the advantages of the angled deck as installed in the *Hermes*. Of aircraft, he admitted that Naval Aviation was not being re-equipped with modern types as quickly as they would have liked, but the Admiralty and the Ministry of Supply were facing the coming year with a good deal more confidence. The slowness was due to a number of causes, which could not be attributed to any one particular Government. In the early stages of the aircraft-production programme after the war it was felt that it was more important for the Royal Navy to get aircraft specially designed for their tasks than to achieve earlier deliveries. That, he thought, had been the main cause of their difficulties.

There had been many delays in the production of the various new aeroplanes, and once more the responsibility did not lie in any one quarter. But nothing was to be gained by recrimination over the past. Our aircraft strength must be safeguarded for the future. That was being done, and he now felt much happier than he was a few months ago; so did the Lords of the Admiralty and the Minister of Supply.

Over a year ago super-priority was given to the anti-submarine Gannet, as a result of which he hoped very much that deliveries would not lag in future. Although there was a hold-up over the earlier deliveries of the Navy's first jet fighter, the Attacker, this aircraft had been in squadron service in H.M.S. *Eagle* since 1952. He knew there had been certain reports that it might not be safe to fire its guns under all conditions. Luckily, that had been proved not to be the case, and he was glad that certain technical troubles with the fuel supply had been put right. Apart from this, there had been rather a tendency to run down the Attackers; but the experts had informed him that they are now performing well in service. They were good aircraft to operate from the deck of a carrier; and their pilots were getting extremely useful instruction and experience in landing jet aircraft on carriers.

They had also had a disappointment over the Sea Hawk. This was mainly due to shortage of labour in the early stages of production, but the Minister of Supply had taken special measures for handling the production line, and they believed it would now go ahead satisfactorily. No. 806 Squadron, formed at Royal Naval Air Station Brawdy on March 2nd, would have Sea Hawks this month, and other Sea Hawk squadrons would follow later in the year.

Then there were the Sea Venom and the Wyvern. The Sea Venom all-weather fighter was in two marks : the production of the first was only just behind schedule; the second mark was delayed because certain modifications were needed for carrying special radar, which they hoped to obtain from America, and by certain difficulties in design which, he hoped, were now being rapidly solved. There had been difficulties, too, with the Wyvern strike aircraft, but it was now cleared for operation from airfields.

Meanwhile, the United States had generously agreed to supply a number of aircraft which would be delivered under the Mutual Defence Assistance Programme. We had had Skyraiders for an operational rôle, and a number of these aircraft were already in H.M.S. *Eagle*, and other supplies were coming along, including a later mark of the Skyraider. We had also been allocated ten Sikorsky S-55 helicopters by America. He hoped that there would be future supplies of helicopters of both heavy and light types.

Mr. Thomas said that we were also receiving under the Mutual Defence Assistance Programme a substantial number of Avengers, which would be particularly welcome as they would strengthen our anti-submarine forces until the Gannet was available in sufficient numbers. H.M.S. *Perseus* had already left to fetch these first Avengers.

In addition to the aircraft which were expected to be in service during the next year or two, a substantial order had been placed for a new Naval jet fighter of the swept-wing type. It would be twin-engined, and would be capable of a very high rate of climb. For obvious reasons he could not give any further information at that stage, but this aircraft was getting super-priority as well. [In this connection overseas journals have mentioned a development of the Vickers-Supermarine 508.]

Among speakers in the debate which followed was Dr. Reginald Bennett (Con., Gosport and Fareham), who—speaking as one who "had some connection with the Fleet Air Arm for a number of years"—questioned the value of aircraft carriers in modern war. We hope to quote his views in a subsequent issue.

AIR TRANSPORT IN RESERVE

Views Expressed During the Air Estimates Debate

LAST week, in summarizing the Air Estimates Debate in the House of Commons, we mentioned that part of the discussion centred on the need for an adequate reserve of transport aircraft. It is now possible to deal with this part of the debate in rather greater detail.

The discussion arose from a motion initiated by COL. GEORGE WIGG (Lab., Dudley). In a most constructive speech, he stressed the revolutionary influence of air power on military thinking during the last 30 years, and argued the importance of a proper assessment of requirements in relation to present-day commitments. He believed the Government would gain valuable knowledge in this respect by studying the various crises that had cropped up in the years from 1920 to 1940, and examining the amount of air transport that would have been necessary to undertake the movement of the actual bodies of troops that were moved on those occasions. In any event, it seemed to him a dangerous assumption that of necessity the strategic reserve must be held in this country; he suggested, therefore, that the Government should look for alternative training grounds and bases where considerable bodies of troops could serve in healthy conditions, where adequate training facilities existed, where the troops could undertake practical exercises, and from where they could be flown to any part of the world where they were needed.

Col. Wigg then proposed an extension of the formula whereby Government support was given to sea carriers like the *Queen Mary*. He asked for a partnership between the Government and the other interests concerned. Obviously the R.A.F. itself must supply an adequate force of transport aircraft, but it would be expensive folly to expect the R.A.F. to meet all transport needs. What was required was a nucleus of experience and a skeleton organization at a high state of efficiency, which could be speedily expanded to meet the needs of an emergency. A second partnership was that of B.E.A. and B.O.A.C., who had very wide operational experience, and could engage not only in the movement of troops but also in building up the Reserve to meet a future emergency. The third element was, of course, the independent operators who, he believed, had a rôle to play, provided there was some measure of public supervision and control. It was by a combination of these various agencies, he suggested, that a reserve of aircraft could be built up.

MR. FRANK BESWICK (Lab., Uxbridge) maintained that mobility of troops was the only possible solution to the apparently contradictory demands for bases abroad and operational forces at home. That mobility could best be achieved, he argued, by the Corporations, who should be given greater fleets and more adequate reserves of air transport machines.

SIR WAVELL WAKEFIELD (Con., St. Marylebone) put the case that more encouragement and help should be given to the private operators and suggested that the Government might make

AIR TRANSPORT IN RESERVE . . .

available on hire-purchase terms modern aircraft which in two or three years' time would be available from the manufacturers, plus reasonable long-term contracts so that they could guarantee security of employment for their employees as well as the ability to plan ahead.

MR. WILFRIED FIENBURGH (Lab., Islington North) said the argument as to whether B.O.A.C. or independent airline aircraft should be used was irrelevant to the strategic movement of troops and stores and equipment. The need, he thought, was for a type of aircraft in sufficient numbers for which loading tables and details had been determined. Otherwise he saw difficulties in the sudden use of various different types of civilian aircraft in an emergency.

MR. CHARLES IAN ORR-EWING (Con., Hendon North) said that Transport Command must remain the nucleus of the air transport aspect. Secondly he contended that it would not be efficient to tie down large numbers of reserve aircraft in the Corporations against the possibility of their being required for military transport operations. That task would be much better undertaken by the more flexible and much smaller charter firms who operated a few aircraft. Of helicopters, he suggested that B.E.A. designs might be developed for military use. It would be desirable, indeed, if a type could be found to emulate the performance of the DC-3, which could take 30 armed men at approximately 150 m.p.h.

Replying, the Parliamentary Secretary to the Ministry of Defence, MR. NIGEL BIRCH, said it was in the country's strategic interest to stimulate as much as was possible civil air transport of all kinds, including commercial air transport and, as well, to build up Transport Command as far as possible. It was to our strategic advantage to use air trooping wherever and whenever that was practicable and reasonably economic. By these methods mobility of strategic deployment could be achieved, and flexibility of movement increased.

He expressed the Government's view that the present size of Transport Command was the right size in relation to the size of the other Commands. But the rôles of Transport Command, he continued, would be primarily of an operational or emergency nature, and civil aviation would carry out the main task in trooping. Plans had already been worked out in detail for the employment of all civil aircraft should war come. Arrangements had been made so that the personnel of the aircraft could be militarized if and when necessary.

He reminded the House that conditions which varied very markedly in different theatres determined whether air trooping was economic or not. Further, it was possible to exaggerate the number of aircraft that would be required for, say, unit trooping. It was estimated that a dozen Britannias, plus operating reserves, could cover all the personnel movement to the Canal Zone and Far East on the present scale.

Mr. Birch then spoke of the Government's anxiety that the civil aircraft industry should expand, and referred to two examinations going on in the Service at present. There was a short-term examination to ascertain whether air trooping to the Far East could be extended by the use of aircraft such as Stratocruisers and Constellations, and a long-term inquiry covering questions such as the length of contracts.

He said that a great merchant navy of the air must be based on commercial operations. Help was needed from the defence aspect, but that was not likely to be much more than marginal, for the Government could not supply a sufficient volume of traffic. It was important, however, that planning should go hand in hand, and the Government were doing their best to see that it did so.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Weapons of Air Defence

CONGRATULATIONS on your intensely interesting article (February 20th) on the above-mentioned matter, by Mr. K. W. Gatland.

Regarding his mention of guided missiles being launched as far as possible from potential targets, he referred to the English Channel. If he meant launching from ships, I personally feel that this would be highly dangerous, as well as expensive. For one thing, such ships and their crews, if any, would be subject to constant air, surface and submarine attack, and the British fleet might have to take abnormal risks in defending them. If sufficient ships were defending the "launchers," an enemy might be tempted to sail an atom-carrying vessel into the defending fleet, and detonate a bomb by radio.

Might I suggest a cheaper "launching platform" in the shape of simple, cabinless radio-controlled helicopters "stationed" at regular intervals along—and away from—the coast? When due for refuelling, they could be brought back quite simply to base after being relieved by another machine. Similarly, a reserve aircraft would be sent out if re-arming was necessary.

As they would be pilotless, great saving in life would result, and surface sea battles avoided in the Channel. Defence would be by self-firing rockets, *à la* Starfire, should an enemy fighter venture near (A-bombers obviously would not!) or "conventional" piloted aircraft—Javelins, Hunters, etc.—on normal patrol. An electronic device on the latter should render them immune from the helicopters' defence arrangements. The latter should also carry sufficient guided missiles for bomber interception in the event of "decoy" aircraft being used.

Being at a certain altitude, the helicopters should alleviate fuel problem of the missiles. Alternatively, the "launcher" could be sea-floated, with engines stopped and indefinite duration. I suggest rotor-tip ramjets (for economy and fire prevention) as a means of power. Re-starting the ramjets should present no great difficulty —an electric motor would suffice. In case of difficulty, small surface-craft would be used.

The helicopters' positions would be observed on a radar screen, and if one were destroyed by some chance, or by some neutralizing electronic device perfected by an enemy (and the possibility must always be allowed for—defence must be 100 per cent effective) a conventional jet fighter could be monitored to the area if one were not immediately available, and a reserve "launcher" sent in to plug the gap.

Again, alternatively, they could be located in groups of two or more to guard against this contingency.

Norwich. VIKING.

H.P. History

WITH reference to J. M. Bruce's excellent article on the Handley Page 0/100 and 0/400 (February 27th), may I offer the following information additionally to the details given in your data on serials and individual machines?

One of the aircraft in the picture of H.P.'s transport fleet at Cricklewood, G-EAAE, was converted from the Service aircraft D8350.

Other civil registrations allotted to converted aircraft were: G-EAKE, KF, KG; G-EALX, LY, LZ; G-EAMA, MB, MC, MD; G-EANV; G-EAPA, PB; G-EASX, SY; G-EATG, TH, TJ, TK, TL, TM, TN. These were all modified to the 0/7, 0/10 or 0/11 standard.

Dudley, Staffs. J. W. GUBBINGS.

Eagle-eyed Readership Dept.

ON page 324 in *Flight* of March 13th a picture caption describes a scene in the Hatfield assembly shop of de Havillands.

The nearest or central line of aircraft is composed of two Trainers, five other Vampires (marks unknown, but *not* Trainers) and two more Trainers. On the photograph, the starboard wing of the first complete aircraft in the next line exhibits a "fence," I think, so surely this is one of a line of Venoms?

Stanmore, Middlesex. R. G. GREGORY.

[Our correspondent is right about the trainers; but we did say in our caption that the line on the left consisted of Venoms. Incidentally, the photograph was not taken at Hatfield, but in one of the other D.H. factories, "somewhere in England."—ED.]

IN BRIEF

Mr. N. Lyons, of 40, Vernon Court, Hendon Way, London, N.W.2, informs us that he has a number of copies of *Flight*, dating from August last up to the present time, which he is willing to dispose of free of charge.

* * *

Dr. A. P. Thurston believes that he was the first man to have experienced "blacking-out" due to g-effects in the air. The occasion was a test of Sir Hiram Maxim's "captive flying-machine," and Dr. Thurston, who had assisted in its design, says that he began to black-out on reaching 6.4g. He wonders if there are readers who recall the tests of this famous amusement-ground device (subsequently installed, we believe, at Earls Court and/or the Crystal Palace) and can remember the date, or other details, of the experience mentioned.

CIVIL AVIATION

DUMMY RUN into the 40ft hold of Bristol's new Freighter Mk 32 by a car of the same manufacture. The first of six "Super Freighters" ordered by Silver City Airways is expected to start work on the cross-Channel ferry on April 1st. This latest model is easily distinguished from earlier Bristol 170s by the longer nose, particularly apparent in this view.

NEW SERVICES TO RHODESIA

FROM April 6th three types of air service, at different fares, will be operated between London and the Rhodesias. The present B.O.A.C. first-class service will be supplemented by "tourist" flights to Lusaka in 56-seat Hermes, with Central African Airways providing connections to other main centres, including Salisbury. Two days earlier, on April 4th, C.A.A. will inaugurate their weekly "Zambezi" coach service between London and the Rhodesias, *via* East Africa and Nyasaland, using 27-seat Vikings. The following single and return fares between London and Lusaka illustrate the different fare-levels to be offered on the Central African route: First-class, £163 and £293 8s; tourist, £130 and £234; colonial coach, £112 10s and £202 10s.

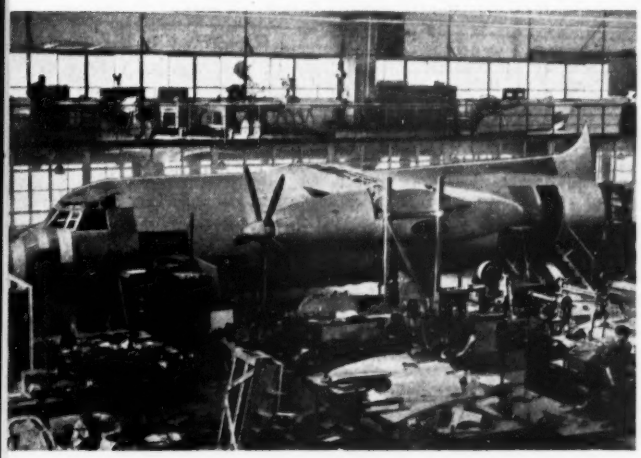
GOOD YEAR FOR T.C.A.

FOR the first time in their history, Trans-Canada Air Lines have carried over a million passengers in a single year. The figure for 1952, which has just been published in the company's annual report, shows that 1,132,518 passengers were carried, representing an increase of 16 per cent over the total for the previous year. After payment of income tax the net surplus was $2,007,879 (£715,100), compared with $3,890,957 (£1,392,000). Operating revenues increased by 15 per cent, but this was more than offset by a 22 per cent rise in operating expenses. Other important figures given in the report are summarized as follows:

	1952	1951	Per cent increase
Total aircraft miles flown	28,600,919	25,090,068	14
Passenger-miles flown ...	653,961,415	545,160,296	20
Passenger-miles available	881,585,954	745,279,578	18
Mail ton-miles	4,843,052	4,468,093	8
Cargo ton-miles ...	5,643,920	4,237,880	33
Express ton-miles ...	1,398,507	1,174,096	19
Revenue ton-miles flown	77,497,093	65,173,848	19
Ton-miles available ...	133,177,327	108,705,797	22

The report notes that "performance of the highest order" was given by the company's Canadair North Star aircraft, 23 of which are in service; of these the majority have now been converted to carry 48 passengers instead of 40. During the busiest traffic months the North Stars achieved the remarkably high daily utilization of approximately 10 hr. The T.C.A. fleet is made up of 27 DC-3s, of which one is equipped as a freighter. Types now on order consist of 15 Viscounts, 3 Bristol Freighters and 8 Super Constellations. The airline believes that, when combined with the present equipment, these machines will constitute "one of the most modern and balanced fleets of air transports in the world today."

FRIENDSHIP: A prototype of Fokker's new Dakota-replacement, the F.27 Friendship, is now under construction. Powered by two Rolls-Royce Darts, it will carry 28 passengers and luggage for 310 miles at 246 m.p.h. Shown here is the wooden mock-up, which, although it was completed last year, has not previously been illustrated.



SPANISH PROGRESS

STATISTICS for the 1952 operations of the Spanish company Aviacion y Comercio indicate healthy increases in the activities of this concern, which operates Bristol 170s and a few Languedocs. Figures are as follows (percentage increase over 1951 figures in parentheses): Passengers carried, 144,859 (17.5); route-miles flown, 1,290,000 (17.6); hours flown, 8,480 (14.1); passenger-miles, 31,850,000 (11.5); tons of freight carried, 569 (10.5); freight ton-miles, 138,600 (32.8); load-factor, 69.55 (6.21).

HUNTING'S DOMESTIC PLANS

NOW that ministerial approval has been granted (*Flight*, March 6th) to the application submitted by Hunting Air Transport, Ltd., for a network of domestic and Continental services centred on Newcastle, the company hopes that at least some of the routes will be opened by May 1st. Approval to operate scheduled services to Oslo, Stockholm, Hamburg, Copenhagen, Amsterdam, Dusseldorf, Luxemburg, Basle and Paris is subject to the agreement of the foreign governments concerned, and the fares proposed by Hunting will have to be acceptable not only to the governments but to I.A.T.A.

Negotiations necessary to secure these agreements may delay the inauguration of the international services, but it is hoped that at least the London-Newcastle route will be inaugurated by the target date. Dakotas will be used initially, offering two return services daily. Departure-times will permit a traveller to arrive in either city in the morning and spend a clear day there before returning in the evening. Overall journey time between the city-centres will be 3 hr 15 min.

Hunting Air Transport have announced their intention to use Vikings as soon as Woolsington Airport, Newcastle, has been improved sufficiently to take the larger aircraft; the Viking will speed up the journey by 20 minutes. The proposed fares for this promising service are £3 10s single and £7 return; subject to Government approval concessions will be made to day or week-end travellers, parties, families and season-ticket holders. In keeping with these inexpensive fares, the service will be of the "coach" type which has given such an impetus to air traffic in many parts of the world. First- and third-class railway tickets on the same route are, respectively, £5 17s 10d (return) and £2 18s 11d (single), and £3 18s 3d (return) and £1 19s 3d (single).

AIRLINE PILOTS' CONFERENCE

THE International Federation of Airline Pilots' Associations is to hold its eighth conference in Chicago from April 6th to 10th. This is the first such conference to be held on the American continent since the Federation was founded in London in April, 1948. Membership comprises nineteen airline pilots' associations, representing about 11,000 pilots.

Subjects for discussion include airworthiness, with reference to approach speeds and landing problems; airborne radar especially anti-collision warning devices; the new phonetic alphabet (which the Federation opposes); and, in particular, the passenger-carrying capacity of aircraft. Members of the Federation are concerned about present developments which they believe are leading to the overcrowding of cabins, and they are

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advocating a re-examination of aircraft designs with a view to providing an adequate number of emergency exits.

In this connection it may be recalled that Lord Brabazon, speaking in London, recently referred to "sardine-packing" in aircraft. On this occasion he was, in fact, considering comfort rather than safety, but he has informed us that, from the A.R.B.'s point of view, the packing of passengers close together—as is being done on low-fare services today—is causing some concern; but he does not think that in this country it has reached a point where regulations are necessary.

I.A.T.A. ON LANDING AIDS

A BOOK comprising a condensed record of I.A.T.A. discussions on factors affecting final approach and landing is to be published from the Association's head office, International Aviation Building, Montreal, P.Q. (price $1.75 U.S. or 12s 6d for residents in scheduled territories). The discussions were held during the Fifth I.A.T.A. Technical Conference, held at Copenhagen in May 1952.

The volume will be concerned with the factual data put forward and the chapter headings will be: electronic aids; aircraft performance; aircraft instrumentation; visual aids; met. requirements; critical height; and economic aspects. Appendices will be devoted to papers on such matters as the accuracy and reliability of radio navigational aids, on instrument presentation, and on performance aspects of the approach problem.

B.I.A.T.A. QUARTERLY GATHERING

THE chairman, A. Cdre. G. J. Powell, and members of the British Independent Air Transport Association, Ltd., held their quarterly gathering on Thursday, March 19th, in H.Q.S. *Wellington*, the Livery ship of the Honourable Company of Master Mariners. Many guests were invited, including air and shipping brokers and travel agents. The opportunity was taken to make known statistics indicative of the expansion during the last six months of 1952 of the operations of B.I.A.T.A. members:—

Aircraft Fleet.—By December 31st the total all-up weight had increased by 50 per cent from three million to four and a half million pounds. The twin-engined fleet numbered 87 and included ten Vikings, eight Bristol Freighters and thirteen Dakotas, while the number of four-engined aircraft had increased from 24 to 43.

Passengers.—In the six-month period, 68,000 passengers were carried on regular scheduled services as compared with 40,000 in the same period of 1950, and the number of passenger miles flown has increased from six million to nearly eighteen million. Scheduled route distances by the end of 1952 totalled 18,300 miles, and routes to be operated in 1953, for which approval has already been obtained, total 35,743 miles and more are expected.

Charter Cargo.—Nearly 14,000 tons of freight were carried in the period apart from the 10,000 tons of motor cars and freight transported on scheduled services.

Charter Passengers.—A good proportion of the increase in passenger charter traffic has been due to air trooping, which has been almost entirely the work of the independent operators. In the last six months of 1952, 112 million troop-miles were flown, over twice as many as in the second half of 1951. In order to undertake trooping, operators had to forgo a proportion of their civilian passenger charter work during 1951, and, in fact, by comparison with 1950 the numbers carried fell by nearly 12,000. However, the increase in number and size of aircraft available in 1952 not only made possible the large increase in carriage of troops, but also permitted 40,000 civilian passengers to be carried.

Referring to broader issues, the B.I.A.T.A. statement stresses the importance of the new policy recently introduced by the Government under which new services being introduced can be operated from a minimum period of seven years and for many cases ten years. Reference is also made to the high standards of efficiency and safety of B.I.A.T.A. operators. One confirmation is found in the regular chartering of members by B.E.A. and foreign airlines needing assistance in operating regular scheduled passenger and freight services. Many B.I.A.T.A. members have agreements with I.A.T.A. carriers for interline and interchange arrangements.

A summary of B.I.A.T.A. members' operations follows:—

Scheduled Services of All Independent Operators

July 1st-December 31st, 1952

Capacity ton-miles offered	3,228,308
Load ton-miles carried	2,168,101
Overall revenue load factor (per cent)	64
Passengers carried	68,664
Passenger-miles flown	17,534,995
Aircraft miles flown	1,820,088
Freight carried (short tons)	10,249
Freight ton-miles flown	565,423
Mail carried (short tons)	11.4
Mail ton-miles flown	7,654
Unduplicated route miles	18,352

Charter Operations by B.I.A.T.A. Members

Capacity ton-miles sold	28,483,804
Load ton-miles carried	17,282,646
Passengers carried—civil	39,893
military	45,926
total	85,819
Passenger-miles flown	131,113,342
Aircraft miles	5,181,972
Freight carried (short tons)	13,898
Freight ton-miles flown	4,771,304

B.I.A.T.A. Members' Aircraft (as at December 31st, 1952)

Aircraft Type	No.	Aircraft Type	No.
York	39	Prince	1
Tudor	4	Anson	8
Dakota	13	Rapide	38
Viking	10	Gemini	2
Bristol 170	8	Dragonfly	1
Dove	7	Single-engined	26
Consul	17		

BREVITIES

MR. T. G. STADDON, who has been B.E.A.'s station superintendent at Elmdon since 1949, has been appointed Midlands sales officer.

* * *

The Hotel Statler in New York City is to be the scene of the second International Aviation Trade Show from June 9-11th; the show will present "a display of representative air materials and services."

* * *

The Dutch postal authorities have stated that in view of the nature of their country and the well developed road and rail transport system, they see insufficient advantages in the use of helicopters to justify the expense of their introduction and operation. This conforms with earlier statements by K.L.M.

* * *

Over a long period there has been talk about Rotterdam having an airport. Most recently permission is being sought to construct a grass field just north of the city. It seems that nearby Ypenburg is to be taken over by a squadron of jet fighters as soon as the concrete runway is completed, and the small aircraft presently using it will have then to move elsewhere. Hence the plans for the Rotterdam grass airfield.

* * *

Seaboard and Western Airlines increased its commercial and military operations across the Atlantic and Pacific by 11 per cent during 1952, achieving a total of 36,598,933 ton-miles. Contracting to the U.S.A.F. between California and Tokyo, Seaboard's Airtrader fleet moved a total of 3,244 tons of freight and 7,674 passengers, including 485 wounded. The airline expects to take delivery of four Super Constellation freighters early in 1954.

* * *

Consideration is being given to the possibilities of Aero-Holland restarting as an independent operator later in the year.

* * *

Avio Diepen has recently obtained a new large contract from the U.S.A.F. for the reconditioning of Dakotas, most of which have been stored in Britain—the first two, in fact, arrived carrying R.A.F. markings. The work will be done at Ypenburg, and it is hoped that further orders for larger aircraft will follow when the airfield is suitable to take them.

* * *

New York travel agents expect that all transatlantic travel records will be broken this summer, and it has been estimated that some 500,000 U.S. tourists will visit Europe during the season. The Coronation will, of course, be a major attraction for American visitors, but France has always been their most popular destination.

* * *

Details of the equipment of the M.C.A. Flying unit were given to the House of Commons on March 11th by Mr. J. D. Profumo, Parliamentary Secretary to the Ministry of Civil Aviation. He said that 17 aircraft were employed: four Avro 19s; one Chipmunk; five Consuls; three Doves; one Gemini; and three Princes. It was intended to reduce this number to 14. The unit was almost entirely employed on the flight-checking of navigational aids and the flight-testing of candidates for Commercial Pilot's Licences and instrument-rating certification.

FROM THE CLUBS

SOME interesting indications as to the cost of sending a gliding team to an international competition abroad are provided in the income and expenditure account recently issued by the British Gliding Association in connection with the world championship in Spain last summer. Altogether, items on the debit side of the sheet amounted to £2,590. The team's travelling and subsistence expenses came to £2,571, but some private and other refunds reduced this figure to £1,326. The next largest item was £546 for insurance, while transport, petrol, oil and carnets cost £321. Miscellaneous ground equipment and sundries accounted for £174 and repairs to gliders and trailers £147.

On the credit side, a generous list of donations by firms and individuals amounted to £1,977 and the team members themselves contributed another £380, making £2,357. This, with a few other credit items, reduced the debit balance to £35, which was met by a £13 surplus from the 1950 contest and £22 from the general funds of the Association.

BAD weather during February kept the Strathtay Aero Club's flying time down to 58 hr 50 min; only 15 days were available for instructional flying, but two members achieved first solos.

A CLUB championship competition, for a handsome trophy, has been organized by Denham Flying Club, in which competitors—for the modest entry fee of 2s 6d—may compete at any time up to September 30th. Marks will be awarded at the rate of 250 maximum for each of four classes : general knowledge (five questions on various aspects of flying), aerobatics, forced landings and cross-country.

Flying time for February totalled 70 hr, a reasonable figure in view of the prevailing weather. Two pilots, one an A.T.C. cadet, gained their P.P.L.s.

LAST year's Ragosine-Auster Homing Trophy Competition attracted 40 entries and this year the Auster Flying Club has made arrangements to deal with a possible list of 50 aircraft. The date chosen is Saturday, May 30th—the nearest Saturday to Coronation day—and, as usual, the competition will be flown from Rearsby. The list of manufacturers' prizes has been further extended. The day's flying will be rounded off by a dinner dance at the Grand Hotel, Leicester. Overnight accommodation will be made available to competing pilots, and, in fact, the only thing they will have to provide for themselves is petrol.

MEMBERS of the Yorkshire Aeroplane Club are putting in plenty of flying, both the Tiger Moths and the Austers being in use six days a week. This is partly due to the closure of Yeadon, a number of enthusiasts having transferred their activities from that airfield, while the club's quota of A.T.C. cadets has been doubled for the same reason.

An informal dance is being held at the club-house tomorrow evening, March 28th, and on April 23rd there will be a ball at the Astoria Ballroom, Leeds (tickets one guinea), in aid of the hospitality fund for the international rally in June.

THE Elstree Flying Club's newly elected committee is now in office under the chairmanship of Colonel H. C. Butcher, with Mr. G. E. Hilder as hon. secretary. Mr. A. Noyes, who was on the C.F.S. staff during the war, has recently joined the club as a part-time instructor.

It has been decided to introduce social membership, at a subscription of one guinea a year. Members in this category will be restricted numerically to 25 per cent of the total membership.

Among several schemes introduced to encourage members to make more use of the club premises is a "club night" each Saturday, when light suppers will be available and the bar will be open from 6.30 p.m. until 11 p.m. The committee are anxious to borrow a 16 mm sound-film projector in order that they may show the Shell Farnborough films and other interesting pictures.

A successful series of lectures has been held during the winter months, and it has been decided to continue these Wednesday evening events, perhaps as discussion meetings.

Bad weather during February limited flying, but 74 hr 35 min was nevertheless recorded.

THE first annual meeting of the Coventry Gliding Club was held at Baginton recently, when it was reported that a two-seater training sailplane would shortly be available for members.

Mr. George Thompson will continue as chief flying instructor, and officers elected were : chairman, Dr. H. N. Gregg; secretary, Mr. Michael Stather Hunt; vice-chairman, Mr. E. Dalton; treasurer, Mr. L. Freeman; committee, Mr. Percy Blamire, Mr. M. A. Boyce, Mr. J. Joss, Mr. B. Gairns, Mr. A. Cleaver, and Mr. M. Robotham.

It was decided to form a limited liability company in order to qualify for assistance from the Kemsley Flying Trust.

After the business of the meeting had been completed, Mr. Jack Rice, of Leicester, showed coloured slides of last year's international gliding competitions in Spain.

R.Ae.C. PILOT'S CERTIFICATES ISSUED—NOV.-FEB, 1952

No.	Name	Cl.	Date	No.	Name	Cl.	Date
28,274	J. O. N. Lawrence	4	3.11	28,295	J. C. Elphick	1	22.12
28,275	G. H. Hunt	1	4.11	28,296	J. H. Fletcher	4	30.12
28,276	E. W. Barber	2	4.11	28,297	J. D. Chapman	4	8.1
28,277	D. J. Sawyer	2	5.11	28,298	G. Baker	4	8.1
28,278	C. P. Trent	3	5.11	28,299	B. J. Jennings	1	13.1
28,279	R. H. Herrold	3	5.11	28,300	D. R. Robertson	1	16.1
28,280	C. A. N. Bishop	1	6.11	28,301	A. K. Allman	4	28.1
28,281	J. K. Nankervis	1	10.11	28,302	T. A. L. Concannon	3	2.2
28,282	G. R. Gibson	3	12.11	28,303	P. Hayter-Preston	1	2.2
28,283	A. B. Campbell	1	12.11	28,304	M. J. Stickler	4	3.2
28,284	A. F. W. Andren	1	19.11	28,305	S. A. Burns	4	4.2
28,285	A. E. L. Wigley	2	21.11	28,306	G. P. Adams	4	4.2
28,286	J. Janes	2	25.11	28,307	F. J. R. Elliott	2	5.2
28,287	E. T. Ware	4	25.11	28,308	M. F. B. Ashdown	4	9.2
28,288	K. Robertson	3	27.11	28,309	J. H. Edwards	4	10.2
28,289	J. M. Lines	1	1.12	28,310	K. Bolton	4	10.2
28,290	D. H. A. Golege-Steel	1	5.12	28,311	R. W. Hare	4	10.2
28,291	A. W. Sawyer	1	9.12	28,312	D. E. Davies	4	11.2
28,292	G. W. Aspin	2	10.12	28,313	N. E. Field	4	11.2
28,293	F. W. Gwynne-Evans	4	19.12	28,314	R. N. Swann	1	12.2
28,294	H. S. Brown	3	19.12	28,315	W. P. N. Moore	4	19.2
				28,316	C. W. Simpson	2	27.2

TIP-TANKED CESSNA

NOT long ago we published some details of the latest Beechcraft Bonanza (*Flight*, February 13th), and now comes news of the new Cessna twin-engined "executive" aircraft. The prototype, the Model 310, made its first flight on January 3rd, in the hands of Henry Waring, Cessna's chief test pilot; and comprehensive trials of this and another prototype are now in hand, with a view to production in 1945.

As can be seen from the photograph, the most striking feature of the new machine is the use of wing-tip tanks, which hold all the fuel and permit the undercarriage to be retracted into the wing. The arrangement has permitted the employment of a wing which —it is claimed—is three feet less in span than would otherwise have been necessary for the desired lift characteristics. All metal stressed-skin construction is used throughout.

Rather than utilizing conventional bearers, engine mounting is of what might be described as "semi-monocoque" type; this is claimed to be the first use of such a method in a light aircraft. The engines are 225 h.p. Continentals with constant-speed fully-feathering airscrews. No performance figures are yet available, but speed range is stated to be excellent, and Mr. Dwane L. Wallace, president of the company, has stated that the Model 310 will "fly faster" than any other small aircraft of comparable type.

Accommodation is for pilot and four passengers, with their luggage. Access to the luggage locker is by a separate door behind the main entrance door, both being situated on the starboard side.

The Cessna 310 appears to be a most handsome little aircraft.

THE INDUSTRY

New Electrostatic Fuel Gauge

ONE of the first electrostatic-type fuel gauges used in aircraft was the Waymouth instrument. It is now widely used in installations where there is no reliable alternative to 24-volt D.C. electrical supply. Such a low-voltage supply does, however, impose limitations on the functioning of electronic apparatus, so Smiths Aircraft Instruments, Ltd., have for some time past been developing alternative systems. They have no intention of superseding the Waymouth gauge for small-aircraft applications, in which it has proved reliable and satisfactory, but they desire to take advantage of the 400-cycle power supplies—now generally available on big aircraft—to measure large quantities of fuel with increased accuracy.

Several Smith executives visited the United States to study systems in use there and, as a result, arrangements have been made with the Liquidometer Corporation, Long Island City, N.Y., for the manufacture and sale in this country of an electrostatic gauge that will fulfil such requirements. This new gauge is based on the principle of the self-balancing capacitance bridge, and includes a means of compensating for fuel characteristics. Thus it can measure with accuracy the weight of fuel in an aircraft, even though the fuel may vary in quality.

The fact that the electrical measurements are made by a self-balancing bridge implies that the accuracy is independent of such variables as supply voltage, frequency and valve characteristics. The result, it is stated, is a gauge with an accuracy which, in favourable conditions, may be of the order of 1 per cent or, under the worst conditions, 3 per cent.

It is claimed that the slight increase in complexity and weight is more than counterbalanced by the saving in reserve fuel made possible by the high precision of reading.

The system is also capable of adaptation for other functions, such as the control of fuel distribution both in flight and during re-fuelling. There is also considerable versatility in layout.

King Aircraft Celebrate

AS briefly recorded last week, King Aircraft Corporation recently held their twelfth anniversary celebration in Glasgow. Some 60 people from all branches of the aircraft industry were guests of the Corporation.

Before a dinner and dance on the Saturday evening, the guests were taken for a tour of the works at Hillington, where, in addition to seeing the ramjet helicopter which we described last week, they were able to inspect a variety of work. Items included the well-known King toggle fastener, of which there are now over 20,000 on order, welded-tube chairs for B.E.A., pipe valves for atomic work at Harwell, flexible couplings for fuel lines, a new crash-release harness (utilizing the Sturge Whiting coupling described in our issue of June 27th, 1952) and a new automatic-locking inspection plate which lies flush with the surface but can easily be released, even by a gloved hand, no screwdriver being required.

At dinner in the evening the chairman and managing director, Mr. J. McEwan King—lately back from a protracted and rewarding visit to the United States—was in the chair. Sir Patrick Dollan, the principal speaker, recalled the time when King Aircraft operated in a "dunney." A dunney, he explained, is a basement room "in which washing is done when the landlord is not looking."

KING AIRCRAFT CORPORATION'S BOARD: Mr. T. G. Llewhellin, Miss Y. Harland (secretary), Mr. J. McEwan King and Mr. J. Love.

Sir Patrick, who is chairman of the Scottish Advisory Council for Civil Aviation, quoted some interesting figures. In 1952, he said, 485,000 passengers used Scottish airports, compared with 10,000 in 1939; and during the war 24,000 Rolls-Royce Merlin engines had been built at Hillington alone. There were now, he pointed out, ten Scottish factories making aircraft and parts.

On the following day the guests were taken for a run through the Highlands, in glorious weather. The route lay through the Trossachs to the Falls of Leny and to Killin, where lunch was taken—with local salmon and local brew. After lunch the route homeward to Glasgow was by way of Glen Dochart, Glen Falloch and a long run down the western shores of the beautiful Loch Lomond. Tea was taken at Tarbet and the journey down Loch Long was in the gathering dusk. Altogether a memorable celebration.

Temperature-Indicating Pigments

WELL-PRODUCED booklets are being issued by Allied Colloids (Bradford), Ltd., 11 Great St. Thomas Apostle, Queen Street, London E.C.4, describing a range of temperature-sensitive paints and crayons for which they hold British marketing rights. The range is that well known under the names "Thermocolour" and "Thermochrom" and manufactured by B.A.S.F., Ludwigshafen.

The former product is supplied in the form of a powder which is dissolved in spirit before application to the part under examination. When the paint reaches a fixed, specified temperature its colour changes immediately and completely, and usually remains in the "changed" state after cooling. Some of the Thermocolours undergo one change, and others several changes, occurring at various temperatures between 40 and 820 deg C.

Thermochrom crayons, which are supplied in boxes of 12 or 15, behave in a similar manner and cover the range 65 to 670 deg C. in fifteen stages. The heated object is marked with a suitable crayon and, if the temperature is that corresponding to the colour-change, the mark will react in one or two seconds. An immediate reaction denotes that the temperature has exceeded that appropriate to the crayon. The object to be tested should, in the case of the crayons, be heated before marking.

Temperature-sensitive indicators of this nature can also be used for a number of specialist inspections such as, for example, the examination of castings for homogeneity. By painting the suspected surface and heating the opposite side of the casting evenly, blow-holes, solid particles and sponginess down to 0.066 mm diameter can be detected. A derivation of this procedure is the heating of a turbine-blade root, the sensitive paint showing the progression of heat throughout the blade. Such procedures are claimed to be more accurate than X-ray or ultrasonic methods.

IN BRIEF

First of a new series of publications by T.I. Aluminium, Ltd., of Tyseley, Birmingham, *Materials and Fabrication* deals with the various types of T.I. alloys and discusses their properties, heat treatment and fabrication. The brochure is well produced and illustrated and will be followed by others dealing with specialized applications of aluminium alloys.

* * *

British Insulated Callender's Cables, Ltd., announce the formation of a subsidiary company in Australia, under the title "British Insulated Callender's Cables (Australia) Pty., Ltd." Authorized capital is £A1,000,000, of which £A400,000 has been issued, and the registered office is at 84/88 William Street, Melbourne, C.I., Victoria, with branches in other Australian States. Sir T. Malcolm Ritchie, M.I.E.Aust., will be chairman.

* * *

Marconi's Wireless Telegraph Co., Ltd., have created a new post of general works manager of all works and model-shops of the company; it will be filled by Mr. Robert Telford, A.M.I.E.E., formerly assistant to the general manager. Mr. J. P. Wykes, A.M.I.E.E., will continue as works manager of the Chelmsford Works, and Mr. E. B. Greenwood, A.M.I.E.E., has been appointed works manager of a new factory now being built at Basildon New Town, Essex.

* * *

From Chamberlain Industries, Ltd., Staffa Works, London, E.10, come details of the latest addition to their range of tube-bending machines. Hand-operated, the new "Truset" machine embodies a new design of back-stop which makes it possible to achieve close-proximity bends without fear of the work slipping or suffering distortion. Offset right- and left-hand bends of well beyond 180 deg can be produced.

SERVICE AVIATION

Royal Air Force and Naval Aviation News

IN CANADIAN SKIES: The R.C.A.F. is the first air force in the world to have jet transport. Depicted above is the first of two D.H. Comet 1as to be used as V.I.P. transports and bomber trainers.

Queen's Colour for R.A.F. Regiment

AT Buckingham Palace, on Tuesday of last week, the Queen presented her Colour to a detachment of the Royal Air Force Regiment. The ceremony took place in the white and gold ballroom. Her Majesty, accompanied by the Duke of Edinburgh, who was wearing for the first time the uniform of a Marshal of the Royal Air Force, stood on the dais in front of the Durbar canopy. The Secretary of State for Air was present.

After the Queen had inspected the parade the Colour was uncased and laid on piled drums for consecration by Canon L. Wright, Chaplain-in-Chief of the R.A.F. At the close of the consecration service, Her Majesty received the Colour from W/C. A. B. Riall, commanding the parade, and placed it in the hands of the Colour bearer, P/O. G. A. King.

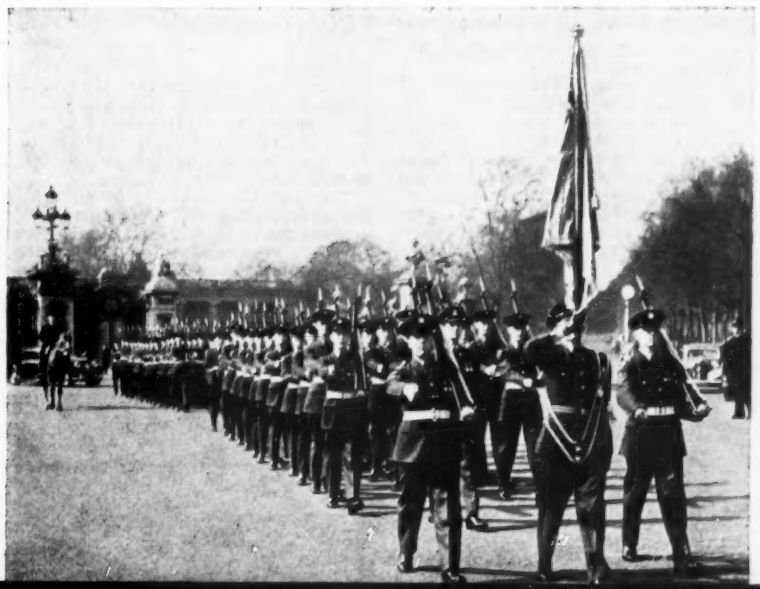
Addressing the parade, the Queen said: "Your regiment was formed in the testing days of the war to protect and defend the airfields from which aircraft of the R.A.F. flew against the enemy. During the 11 years that have passed since its foundation, your regiment has shown itself firm and devoted in performing duties often beyond those originally assigned to you. You have performed them in a manner worthy of the high traditions of the Royal Air Force, of which you are a part.

"I know with what pride my father watched your regiment earn its reputation in the field. I know, too, that this reputation is being upheld in the many parts of the world where the regiment is serving."

Her Majesty's address was replied to by A.V-M. Sir Francis Mellersh, Commandant General of the R.A.F. Regiment, and then, in slow time, the Colour was marched to its position. The parade gave three cheers for the Queen. Later the detachment, with fixed bayonets and the new Colour flying, marched to Wellington Barracks.

Following the presentation, the Commandant General and officers of the R.A.F. Regiment gave a luncheon reception at the Royal Air Force Club, at which a number of distinguished guests were present, including members of the Air Council and most of the R.A.F. commanders-in-chief.

H.R.H. THE DUKE OF EDINBURGH wore the uniform of a Marshal of the Royal Air Force, for the first time, at the presentation of the Queen's Colour to the R.A.F. Regiment. (Below) The Regiment, with the Colour flying, leaves Buckingham Palace.



Esher Trophy

FOR 1952, No. 610 (County of Chester) Squadron, R.Aux.A.F., has won the Esher Challenge Trophy for operational efficiency. No. 610 is equipped with Meteor 8s and commanded by S/L. J. E. Storrar, D.F.C. Runners-up were No. 615 (County of Surrey) Squadron, R.Aux.A.F., commanded by S/L. F. B. Sowrey.

New Staff College Commandant

UNTIL recently commanding the Transport Wing, M.E.A.F., A. Cdre. G. P. Chamberlain, C.B., O.B.E., has been appointed to command the R.A.F. Staff College, Andover. A. Cdre. Chamberlain first went to the Middle East, as A.O.A. No. 205 Group, in 1950.

Sea Hawk Squadron Commander

THE new Sea Hawk squadron—No. 806—at Brawdy, Pembrokeshire, referred to by the First Lord of the Admiralty when he presented the Navy Estimates in the Commons recently, is to be commanded by Lt. Cdr. P. C. S. Chilton, R.N.

Lt. Cdr. Chilton has a long Service-flying career. In the war he was a fighter pilot in the Western Desert and also embarked in the aircraft carriers H.M.S. *Furious* and *Glorious*. In 1944 and 1945 he commanded Nos. 1843 and 1849 Squadrons, equipped with Corsairs.

Quinton Trophy

A TROPHY in memory of the late F/L. J. A. Quinton, G.C., was presented last week to the R.A.F. by the A.T.C. Taking the form of a ceremonial baton, it will be awarded to the best ex-A.T.C. cadet at each passing-out parade at Halton.

The presentation was made by Cdt. F/S. S. Wallon and received by Air Marshal Sir Francis Fogarty (Air Member for Personnel).

The A.T.C. cadet, Derek Coates—whose life was saved when, in a Wellington accident, F/L. Quinton fastened the only available parachute on him—was present at the ceremony. He is now serving in the R.A.F.

Reunion

The fifth reunion of past and present members of the W.A.A.F. and W.R.A.F. will be held at Londonderry House, Park Lane, London, on Friday, April 24th, at 6.30 p.m. Tickets (14s 6d) from Miss P. Bruzaud, O.B.E., Highfield End, West Byfleet, Surrey.

SERVICE AVIATION . . .

TRANSPORT COMMAND TEN YEARS OLD

A Brief Survey of the Work and Duties of the Youngest Operational Command

THIS month—on March 25th to be precise—Transport Command celebrated its tenth anniversary. It was born at Harrow under the command of Air Marshal Sir Frederick Bowhill and quickly took its place with the other operational commands, contributing "strategic mobility" to air power.

A system of centralized control was introduced which embraced all overseas theatres and operated through groups, wings, stations and staging-posts. In 1943, when the Command was formed, it controlled 70 aircraft. Two years later, at the end of the war, it was the largest in the R.A.F., having 12 groups controlling 58 squadrons.

War-time activities covered five main tasks: (1) Overseas ferrying of aircraft (ferrying in Britain was performed by Air Transport Auxiliary); this was a very big and difficult task, especially while the direct Mediterranean route to the Middle and Far East could not be used. (2) The operation of air transport along trunk routes and within the main theatres of operations. (3) Transport support, i.e. the use of transport aircraft in direct support of military operations; this took the form of dropping paratroops, towing gliders and supply-dropping. The classic examples of the use of transport support were, of course, the invasion of Normandy, the Arnhem operation, the crossing of the Rhine and the continual supply for the Fourteenth Army fighting in Burma, which depended on air supply for 95 per cent of its requirements. (4) Special flights, such as taking the Prime Minister to Yalta or ensuring the arrival of officials at conferences in many parts of the world. (5) Training the thousands of aircrew to fly transport types of aircraft and teaching them the operating procedures.

At the conclusion of hostilities in Europe, Transport Command was greatly expanded to allow for a liberal use of air transport in the re-deployment of our forces in the Far East. Pilots and ground crew were transferred on a large scale from Bomber and Coastal Commands, and their aircraft modified to carry passengers. This was a major task in which none of the normally accepted requirements for a transport service was present. Nevertheless, by intensive training the necessary standards were achieved until, at the peak, aircraft were leaving the United Kingdom for India at hourly intervals, with a proportion continuing to Singapore and with great numbers engaged on transport operations within each theatre.

It was at this period of intensive flying that there was something of a public outcry against the number of accidents. This phase, however, was very short.

With the end of the war against Japan, plans were quickly worked out to use air transport to supplement the inadequate shipping resources which were to bring men home; but before they could be made effective the demobilization of the key maintenance personnel enforced a contraction of effort, which did not cease until the Command was finally stabilized at its post-war strength. Nevertheless, many thousands of Service men and women were brought back to this country by air during 1945 and 1946.

During this period of demobilization attention was turned to preparing the way for the re-birth of British civil aviation. A special wing was formed at Croydon to provide the nucleus of British European Airways, and the North Atlantic Ferry Service which had been operated by B.O.A.C. on an agency basis was returned to the company. But of major importance were the steps taken, especially in Europe and the Middle East, to provide an air-traffic control organization and the whole communications network on which it depended. It was during this period, also, that a number of pioneering ventures were started. A squadron of Mosquitoes were used to provide a daily service to ensure British newspapers being on breakfast-tables in the capitals of Europe as far east as Vienna. This was at a time when it was vital that British ideas and British interpretation of events should be available in these countries.

The Command also inaugurated a daily service between Blackbushe and Prestwick to demonstrate the value of electronic aids in enabling a regular schedule to be kept in all weathers. During the year which it was in operation only two flights in this service were cancelled.

As an extension of this demonstration much thought was devoted to the problem of landing numbers of aircraft rapidly in bad visibility, since this was recognized as likely to be one of the major problems confronting civil aviation. In conjunction with the Ministry of Civil Aviation, two systems were developed which were demonstrated to the international representatives of P.I.C.A.O. The rates then achieved under most difficult conditions set a standard which has not so far been surpassed.

With this demonstration it was felt that the immediate post-war objectives of the Command were complete. The three civil airline Corporations had been formed and the Command again turned to its own training.

Throughout its history this Command has demanded the highest possible standards of flying ability, and the reputation it enjoys throughout the world is a direct reflection of the high quality of the training. It may not be commonly known that in the interests of passenger safety Transport Command were responsible for the introduction of backward-facing seats in transport aircraft.

The first big test in peace-time was the Berlin Airlift in 1948; every available aircraft was working at maximum intensity. Two years later, when tension was mounting in the Middle East, a reinforcement operation was carried out in which 2,300 troops of the Third Infantry Division and 1,400 R.A.F. technicians were carried from the United Kingdom to Egypt within one week. This operation again demonstrated the fact that even a small transport force, provided it is highly flexible, well trained and its morale high, can play a major part in giving mobility to all three services.

During the past 12 months the Command has been called upon to meet a number of important and interesting commitments in addition to the normal tasks of providing services to widely dispersed localities such as Japan, Singapore, Australia, Middle East, Warsaw, Germany and Canada.

Last September there was the problem of finding the small ice-cap camp and dropping supplies to the Greenland expedition. The dropping zone was 8,000ft above sea level and 500 miles from the operating base at Thule. Despite adverse conditions 192,000 lb of supplies, including a prefabricated hut in sections, an electric generator, stoves, sledges and a ton of dog meat, were dropped successfully. One Hastings was lost on this task, but the crew was rescued by the U.S.A.F.

Fresher in the public mind is the Command's effort in "Operation Sandbags," when its aircraft collected and delivered to airfields near the scenes of the recent floods 2¾ million sandbags, weighing 720 tons, in four days.

Apart from transport duties, however, the Command is still responsible for overseas ferrying. Vampires have been taken to and fetched from the Far East and, at the moment the ferry pilots are busy bringing Canadair-built Sabres to Britain. There are between 300 and 400 of these aircraft to be fetched.

Transport Command can be justifiably proud of its first ten years. Its headquarters are at Upavon, one of our very earliest Service stations, and its staging posts encircle the world. It has the ability not only to take part in any kind of transport operation required by the dictates of the cold war, but can, in addition, help to pay for its keep by the carriage of passengers and freight. Peace or war, Transport Command must operate, and in any operation the Command is of its very nature the first to give service.

TO FILL SEA-WALL GAPS. Loading sandbags on to a Valetta of Transport Command at Kloten airport in Switzerland. The two receiving stations in Britain were Waterbeach in Cambridgeshire and Manston on the Kent coast.

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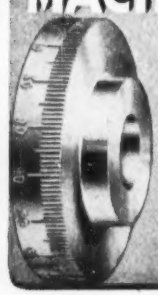

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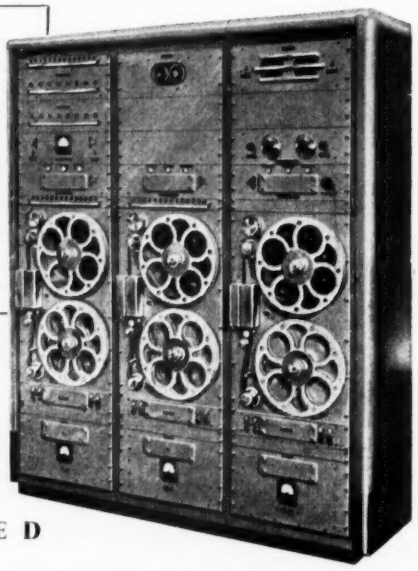

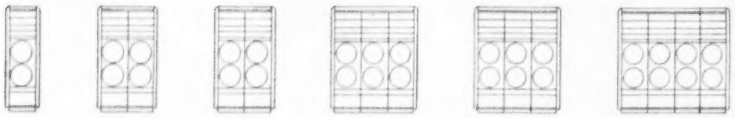

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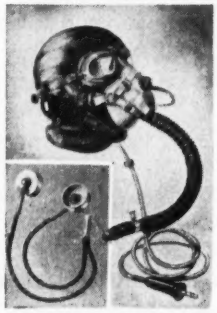

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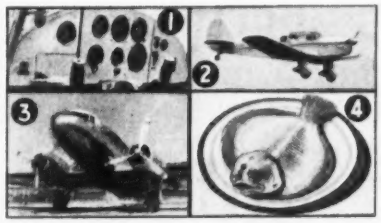

We hope that you found all the answers to your satisfaction (see page 28), but would like to mention that no prizes are offered even to Nephew Harry, who was clever enough to ask for one last month! But you may like to know that we have the following used aircraft in excellent condition, and should be pleased to supply further details upon request:—

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THE proprietor of British Patent No. 614425, entitled "Latch Assembly," offers same for licence or otherwise to ensure practical working in Great Britain.—Inquiries to Singer, Stern and Carlberg, 14, East Jackson Boulevard, Chicago, 4, Illinois, U.S.A. [9389

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:—

Application No. 180, from Transair, Ltd., of Croydon Airport, Surrey, for a seasonal inclusive tour service with Dakota aircraft for the carriage of passengers and supplementary freight between London (Gatwick) and Rijeka (Yugoslavia), with an intermediate traffic stop at Ljubljana, at a frequency of one service weekly during the period from May 1st, 1953, to October 31st, 1953.

Application No. 181 from Airwork, Ltd., of 15, Chesterfield Street, London, W.1, for an all-freight service, initially with Avro York, Bristol Freighter, Dakota or Bristol Britannia aircraft, or comparable types, for the carriage of freight between London Airport and Rome (Ciampino) with an intermediate traffic stop at Marseilles (Marignane), at an initial frequency of from two services weekly to one service daily during a ten-year period commencing three months after the date of approval.

THESE applications will be considered by the Council under the terms of reference issued to them by the Minister of Civil Aviation on July 30, 1952. Any representations or objections with regard to these applications must be made in writing, stating the reasons, and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 9, Buckingham Gate, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, must reach them within the period allowed for the making of representations or objections.

THE Council also give notice that the following applications have now been withdrawn:—

Application No. 48, from Skyways, Ltd., of 7, Berkeley Street, London, W.1, for a colonial coach service between London (Stansted) and Kingstown (Jamaica) with York aircraft, which was advertised in *The Times*, *The Aeroplane* and *Flight* on October 3rd, 1952.

Application No. 104 from Hunting Air Transport, Ltd., of 5, Fitzhardinge Street, London, W.1, for a colonial coach service between London (Bovingdon) and Dar-es-Salaam (Tanganyika) with Viking aircraft, which was advertised in *The Times*, *The Aeroplane* and *Flight* on November 7th, 1952. [9431

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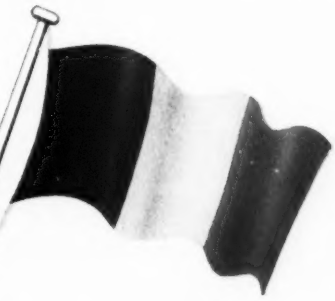

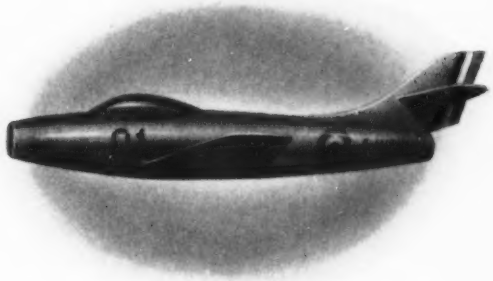

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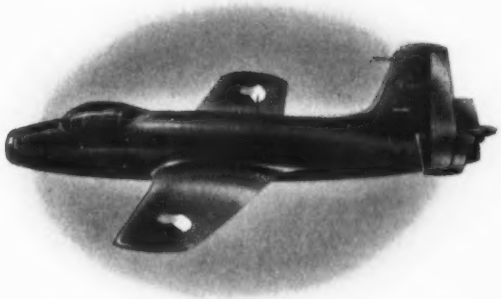

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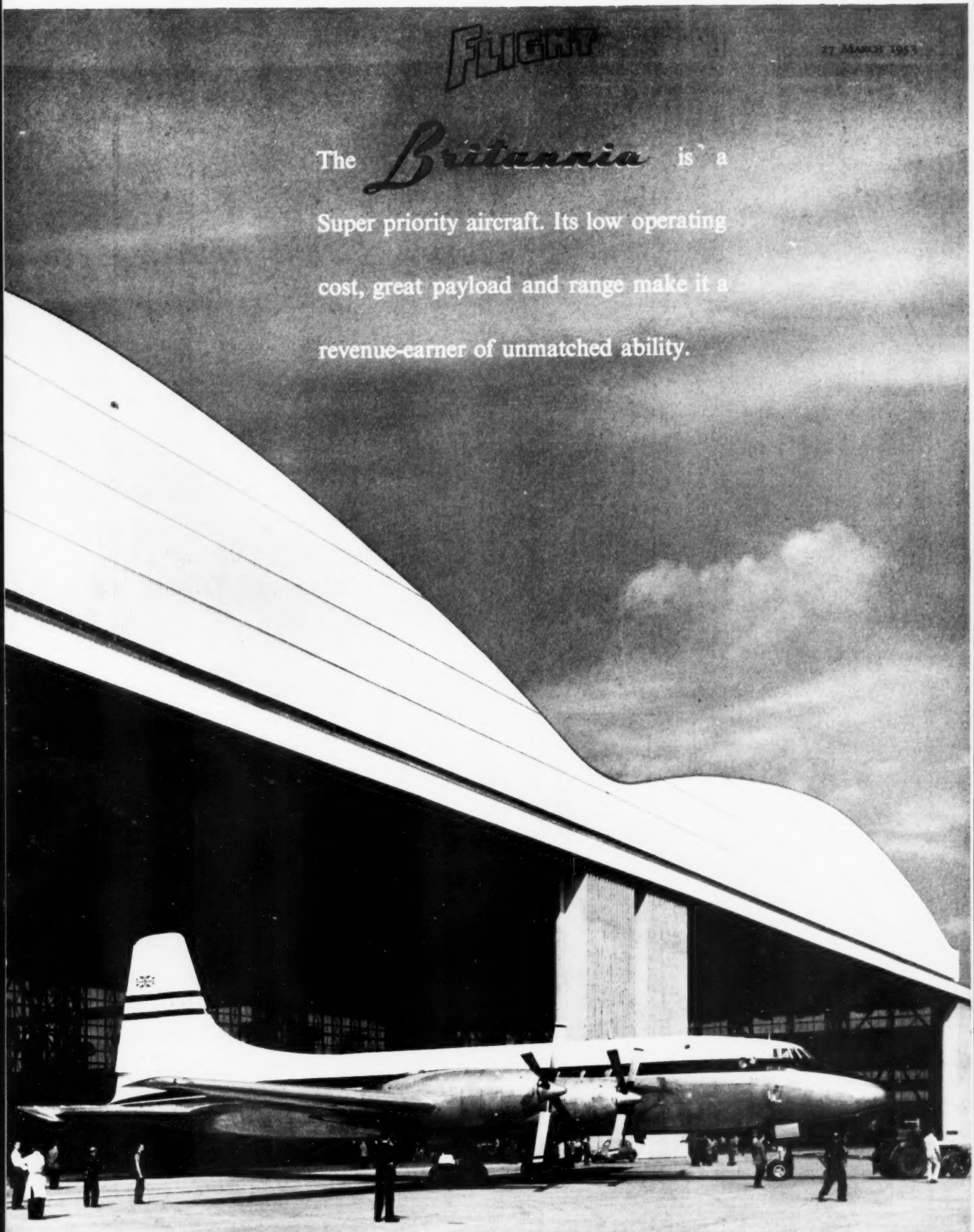

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